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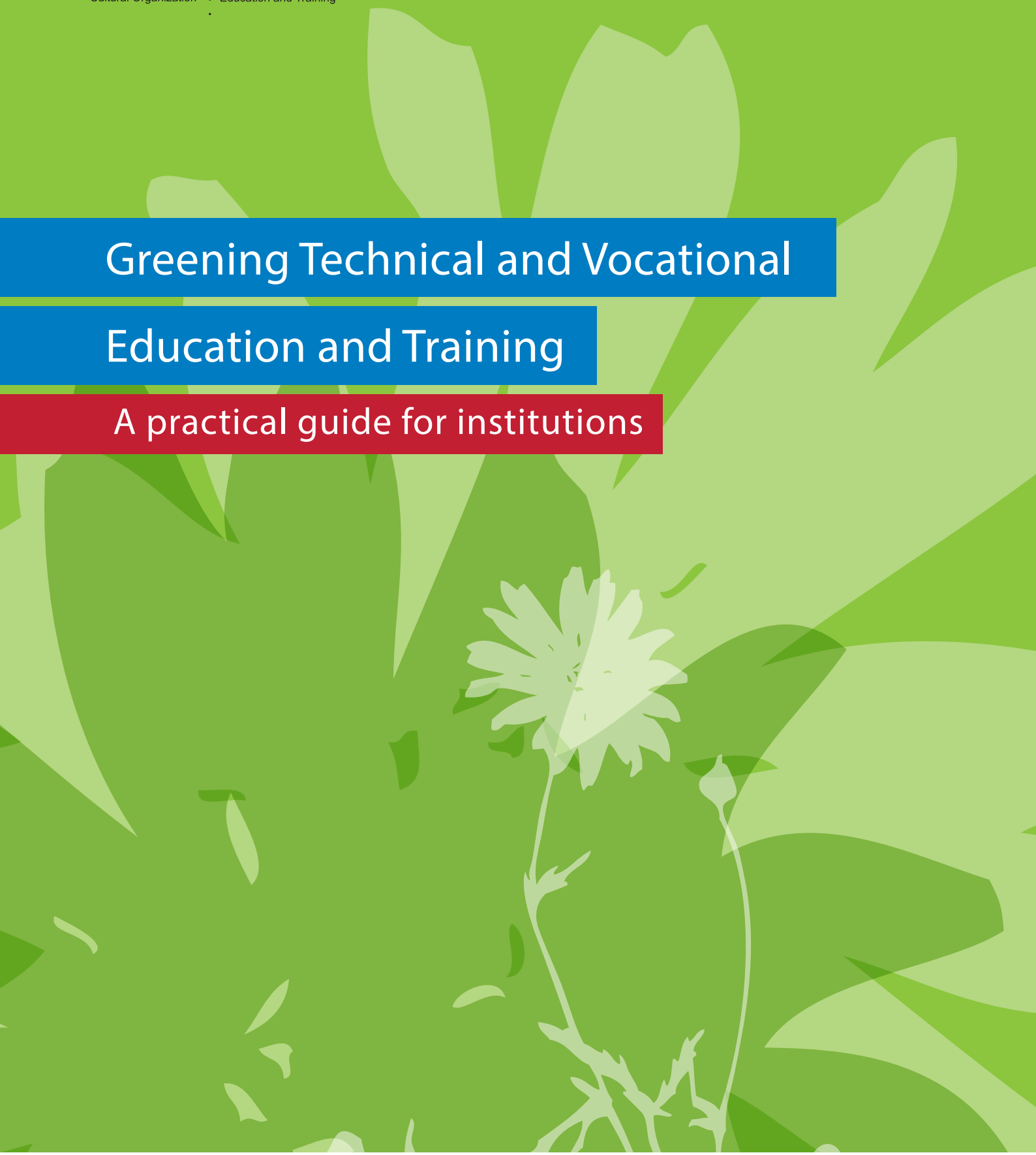
UNEVOC
International Centre
for Technical and Vocational
Education and Training

Greening Technical and Vocational Education and Training

A practical guide for institutions



Education 2030

Greening Technical and Vocational Education and Training

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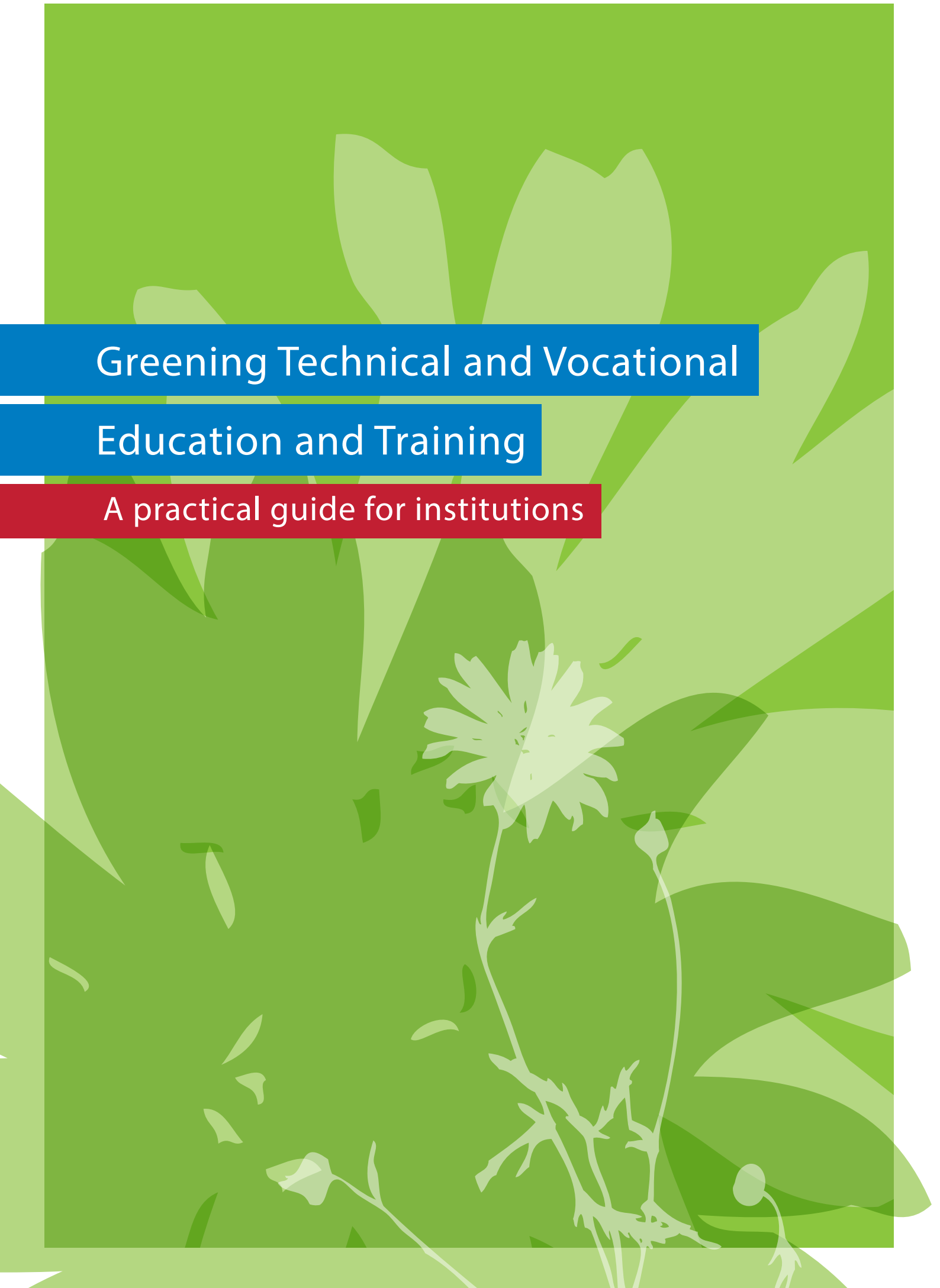

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FOREWORD

This *Guide* is designed to help leaders and practitioners of technical and vocational education and training (TVET) in improving their understanding and implementation of education for sustainable development (ESD) using a whole-institution approach to greening their institutions. The *Guide* reflects the objective of the UNESCO-UNEVOC International Centre for TVET to assist TVET institutions in their journey towards transformation. This is consistent with its advocacy since 2011 of initiating reforms that meet the twin challenges of youth unemployment and low capacities in the field of sustainability across the TVET sector. These reforms should be based on holistic and coherent transformations of institutions, rather than broken paths to institutional change that are lacking in long-term vision. The UNEVOC Network – a global network of TVET institutions in UNESCO Member States – is at the forefront of formulating strategic responses to carry out transformations of TVET in Member States as countries increasingly commit themselves to develop solutions and adequate responses for lower greenhouse gas emissions and a reduced carbon and ecological footprint as a result of human activities. For this reason, the support of UNESCO-UNEVOC is targeted primarily at those who are already within the Network, with the hope that they can serve as conduits for multiplying awareness and education, scaling up training responses and positively influencing institutional stakeholders, communities, enterprises and industries towards adapting more responsible practices, particularly in sectors with the highest impact on the environment.

The processes and guiding examples presented in this *Guide* are an illustration of a systematic journey towards empowering TVET institutions to adapt to the changing needs of the green economy, and sustainable and digital societies. Where greening is a national priority, it is deemed necessary for TVET institutions to support transitional progress to sustain these efforts. The jobs and employment promises of green economic transitions are at the heart of the institutional greening agenda. However, it should not be ignored that making TVET more attractive to learners, communities and enterprises through the promotion of green skills is underpinned by the greening of TVET institutions, which are often faced with basic issues and the day-to-day struggle of promoting TVET. Preparing the workforce not only for the jobs that exist now but for those of the future is another reason for reinforcing greening. This requires a change of mindset, while becoming aware of the knowledge, skills and attitudes that are sensitive to environmental, economic and social development.

The *Guide* is divided into two sections and discusses four key steps, focused on understanding, planning, implementing, and monitoring and assessment. It delivers several key elements to assist TVET leaders and their institutional teams in understanding the scale, scope and crucial steps in greening their institutions and programmes. The *Guide* explains the need for greening, and its institutional benefits. It also addresses key elements in creating the rationale and strategy prior to launching. The core elements of creating an institutional greening plan, addressing short, medium and long-term goals, are outlined in the *Guide*. Section 2 addresses step-by-step suggestions for implementing, developing and assessing the greening processes. Finally, this *Guide* offers suggestions to help institutions find further resources.

This publication is another step taken by the UNESCO-UNEVOC International Centre for TVET to reinforce sustainable development as a learning journey, not a destination; and to support institutional capacity development among its stakeholders in TVET, which may lead to the creation of a concerted effort to mainstream sustainable development in TVET.

SHYAMAL MAJUMDAR
Head of UNESCO-UNEVOC International Centre for TVET

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GLOSSARY

GREENING	The process of pursuing knowledge and practices with the intention of becoming more environmentally friendly, enhancing decision-making and lifestyle in more ecologically responsible manner, that can lead to environmental protection and sustainability of natural resources for current and future generations.
GREEN JOBS	Jobs that contribute to preserving or restoring environmental quality, while also meeting longstanding demands and goals of the labour movement, such as adequate wages, safe working conditions and workers' rights (UNEP et al., 2008).
GREEN SKILLS	The knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society (CEDEFOP, 2012).
SUSTAINABLE DEVELOPMENT	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UNCED, 1987).
RETRAINING	Training enabling individuals to acquire new skills giving access either to a new occupation or to new professional activities (CEDEFOP, 2008).
TRANSFORMATION	A process of allowing institutions to change to adapt to the changing functions and expectations, or to shift according to the changes in the functions over time (Campbell, 2007).
UPSKILLING	Short-term targeted training typically following initial education or training, and aimed at supplementing, improving or updating knowledge, skills and/or competences acquired during previous training (CEDEFOP, 2008).

USING THIS GUIDE

Greening Technical and Vocational Education and Training: a practical guide for institutions is designed to help leaders and practitioners of technical and vocational education and training (TVET) in improving their understanding of, and implementing, education for sustainable development (ESD). It is guided by a whole-institution approach, and uses a step-by-step process that can be applied in an institutional setting. The process consists of four steps: understanding, planning, implementing, and monitoring and assessment. The *Guide* identifies several key elements to assist TVET leaders and their institutional teams in understanding the steps in greening their institutions and programmes. It explains the need for, and the institutional benefits of, greening. It also addresses key elements for creating the rationale and strategy prior to launching the first step. The core elements of creating an institutional greening plan (IGP), addressing short, medium and long-term goals, are outlined in **Step 2**. Then **Steps 3 and 4** address suggestions for implementing, developing and assessing the greening process.

BOX 1
WHOLE-INSTITUTION APPROACH

In addition to the reorientation of teaching and learning content and methodology, a whole-institution approach considers an integrated process for mainstreaming sustainability in the whole process of an institution.

The *UNESCO Roadmap for Implementing the Global Action Programme on Education for Sustainable Development* suggests areas in which this approach can be realized:

(a) An institution-wide process is organized in a manner that enables all stakeholders – leadership, teachers, learners, and administration – to jointly develop a vision and plan to implement ESD in the whole institution.
(b) Technical and, where possible and appropriate, financial support is provided to the institution to support its reorientation. This can include the provision of relevant good practice examples, training for leadership and administration, the development of guidelines, as well as associated research.
(c) Existing relevant inter-institutional networks are mobilized and enhanced in order to facilitate mutual support such as peer-to-peer learning on a whole-institution approach, and to increase the visibility of the approach to promote it as a model for adaptation.

In practice, a whole-institution approach suggests the incorporation of sustainable development not only through the aspects of the curriculum, but also through an integrated management and governance of the institution, the application of a sustainability ethos, engagement of community and stakeholders, long-term planning, and sustainability monitoring and evaluation.

Source: UNESCO (2014)

The *Guide* situates a whole-institution approach in different education and training settings and across different actors (learners or trainees, teachers, principals, training managers and even those that are not traditionally part of an 'academic' structure but with whom institutional actors interact).

TVET is a complex sector, in which a wide range of skills and knowledge is imparted in a wide range of settings. The whole-institution approach takes into account these complexities and justifies the need for an integrated institutional development. The process requires the planning of responsibilities that can be performed by different actors within an institution setting to create an institution-wide change; the anticipation of the further roles that these actors take up in their personal and professional life to influence inputs, processes and outcomes; and preparation to perform these roles in any workplace setting and in life situations. These actors are to be equipped with the knowledge, skills and competencies to effect the necessary change and perform their roles to the point that sustainability is embedded in everything they do. The whole-institution approach also develops work-related skills and competencies. Both life and work-related skills and competencies affect the manner in which individuals in the community conduct themselves when dealing with day-to-day personal and professional functions and activities.

OVERVIEW OF THE GUIDE

Section 1 gives an introduction and sets the background regarding Education for Sustainable Development (ESD), and its relationship to Quality Education, Agenda 2030, Education 2030 and Global Citizenship Education. It explains the many initiatives that learning institutions are being requested to deliver. As time and resources are limited, it is important to explore the possibility of synergy of these initiatives with greening TVET institutions. The introduction explains what ESD is and how it is linked to TVET, as well as to education in the broadest terms. It outlines why greening and ESD in general matter to TVET institutions, to society and particularly to students.

Section 2 outlines a four-step framework for the greening of TVET institutions, implying a whole-institution approach.

AN OVERVIEW OF THE STEP-BY-STEP GUIDE

Step 1

looks at **understanding the process** of greening TVET institutions. It explains why it is important to undertake a greening process, and how it could be positioned for an institution within a multi-level and multidimensional approach to reform in the context of sustainable development. This step outlines the scale, scope and range of greening, including economic, social and environmental actions. Importantly, it helps teams within institutions understand the nature, the broad approach and the scale of the required changes. It offers helpful and quick reference to the five approaches for implementing ESD in TVET institutions.

Step 2

deals with **planning the process** of greening. It is important to develop a planning framework and strategy before starting the main greening process. The step outlines strategic planning approaches, such as building the motivation for a whole-institution approach, developing a vision, the engagement of key stakeholders and help in setting priorities. To give guidance on how these priorities could be implemented, examples are provided. These offer ideas and methods for organizing activities around a green plan.

Step 3

focuses on **developing an implementation strategy**. This step builds on the five approaches for implementing ESD in TVET institutions, and identifies opportunities for making them operational within the daily routine of the institution. Its suggestions will assist with the core tasks of creating an institutional policy framework to allow simultaneous work on Greening the Campus, Greening the Curriculum and Training, Greening Research, Greening the Institutional Culture, and assisting the broader workplace and community in their own greening efforts. This chapter also offers some examples.

Step 4

is to **monitor and assess the efforts and results** of the greening process. This step describes the need both to develop assessment criteria that can be communicated and celebrated, and to recognize that some hoped-for outcomes do not lend themselves as readily to assessment. These more difficult to assess outcomes must not be overlooked in the planning and implementing phases. While quantitative measures indicate progress in, for example, energy and water consumption, it may be necessary to supplement this with qualitative assessment based on the opinions of employers, faculty and graduates.

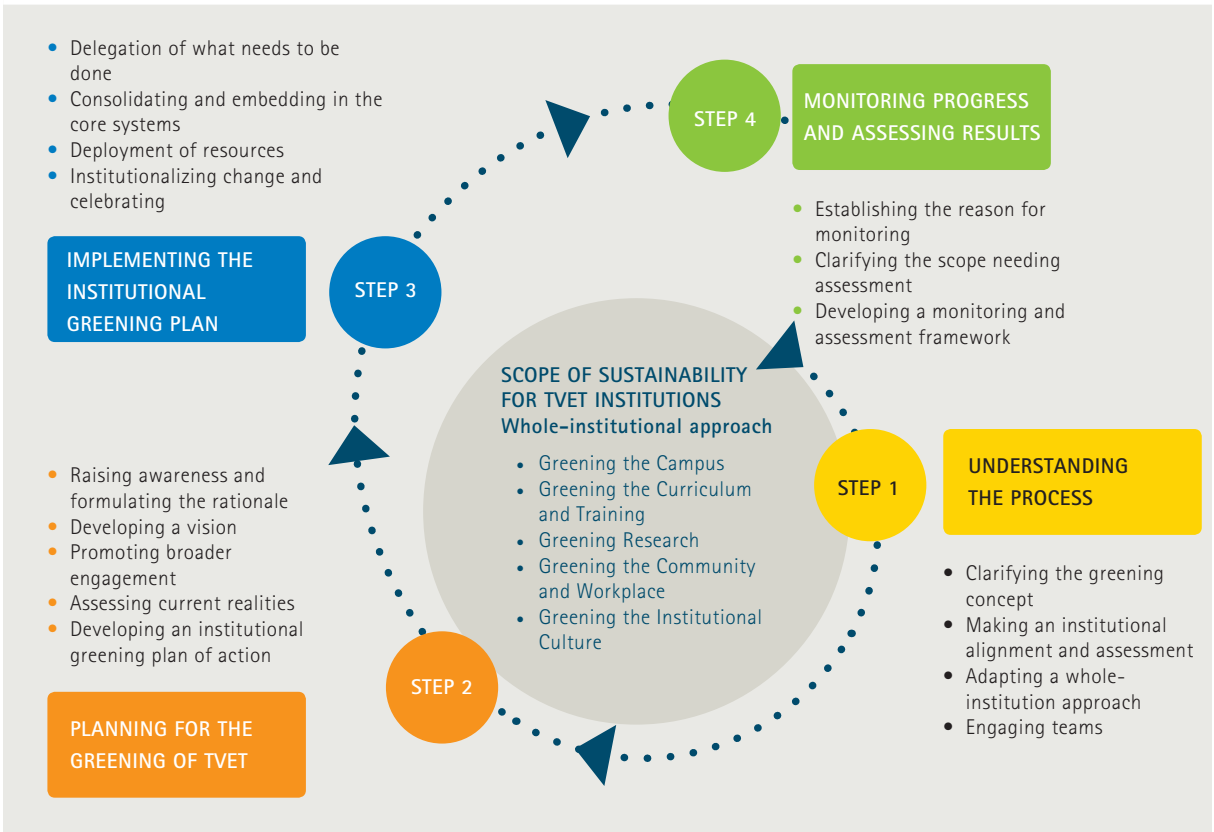
AN OVERVIEW OF THE FIVE APPROACHES FOR IMPLEMENTING ESD IN TVET

Within the key steps are individual approaches for implementing ESD in TVET institutions: Greening the **Campus**, Greening the **Curriculum and Training**, Greening **Research**, Greening the **Community and Workplace** and Greening the **Institutional Culture**.

The approaches are independent actions that make up a whole-institution approach. Examples showing how other institutions have started to introduce the greening process are important features of the *Guide*. They show both different approaches to sustainability and different areas in which they can be applied.

The **Appendix** provides a sample monitoring and assessment framework.

FIG. 1
STEP-BY-STEP GUIDE FOR IMPLEMENTING ESD IN TVET INSTITUTIONS



TARGET AUDIENCE

This *Guide* is designed as a practical tool for TVET institutional leaders, administrators, managers and teaching personnel to assist them in creating their own successive steps towards the greening process in their institution. It serves as a powerful tool to inspire the development of localized policies, programmes and practices, as well as improvements to structures and investments, both capital and human. Students and the broader school community could also benefit from this information, since they are instrumental in the successful implementation of the greening process.

LIMITATIONS

Greening is an emerging and ongoing concept that has an infinite timeframe. We recommend that institutions pursue a formal greening process until they are confident that the concepts are embedded, that the actions are mainstreamed into daily functions, and that they are covered in routine monitoring measures. Since TVET institutions vary widely, from small rural handicraft centres to highly advanced technical schools, it will be necessary to adapt the generic advice offered here to suit the specific learning situation.

This *Guide* is designed primarily for vocational institutions that deliver programmes within their own school, college or independent setting, where the administration and teaching or training personnel have control over the facility and the educational programme/curriculum and training. However, the general principles outlined will be a useful starting point for any formal TVET institution wanting to initiate a systemic transformation. They are also broadly applicable to the content and processes of other types of institution and TVET delivery system. For example, the four practical steps outlined in the *Guide* could be adapted by TVET managers or trainers who are involved in upskilling activities in a workplace setting, and who aim to bring about the broad changes described in the text.

Since it is to be used to create a starting point for building systemic transformations, the *Guide* does not define what a 'greened TVET institution' should look like, since this will largely depend on prior assessment of the existing level of implementation of ESD in the different areas of an institution. Similarly, greening TVET institutions will rely on their own abilities to make a plan, as well as the resources available to them to advance the idea of transforming the institution. Thus, the *Guide* sets out helpful measures to facilitate institutions in their journey, and offers a set of possible outcomes to be pursued.

SECTION ONE

INTRODUCTION

Technical and vocational education and training (TVET) systems play an important role in equipping youth and adults with the skills required for employment, decent work, entrepreneurship and lifelong learning. In the present development context, TVET can equip youth with the skills required to access the world of work, including skills for self-employment. TVET can also improve responsiveness to changing skill demands by companies and communities, increase productivity and increase wage levels. TVET can lower barriers that limit access to the world of work.

Implementing ESD in TVET can serve as an enabler of transformation in TVET institutions by enhancing the sustainability scope of an institutional vision and increasing opportunities to build the capacities of the community and stakeholders in it. In effect, ESD in TVET provides an enhanced tool to equip youth and adults with the skills needed in the changing world of work, including the knowledge and competency requirements to make the transition to green economies and societies. ESD is therefore essential for institutions to educate and train individuals on these requirements.

BOX 2
DEFINING TVET

UNESCO defines TVET through a range of learning activities, and describes it as an important route for developing individuals who will be future agents of sustainable transformations.

The *UNESCO Recommendation concerning technical and vocational education and training* (2015) defines TVET 'as comprising education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods. TVET, as part of lifelong learning, can take place at secondary, post-secondary and tertiary levels and includes work-based learning and continuing training and professional development, which may lead to qualifications.

TVET also includes a wide range of skills development opportunities attuned to national and local contexts. Learning to learn and the development of literacy and numeracy skills, transversal skills and citizenship skills are integral components of TVET.

TVET contributes to sustainable development by empowering individuals, organizations, enterprises and communities, and fostering employment, decent work and lifelong learning so as to promote inclusive and sustainable economic growth and competitiveness, social equity and environmental sustainability.'

Source: UNESCO (2016a)

Why TVET institutions must engage in the greening process

TVET plays an important role in helping make transitions to a low-carbon economy and climate-resilient society. It is carried out through the traditional roles of TVET in preparing learners for occupational fields and increasing their participation in the world of work. These traditional roles are facing new expectations:

TVET for educating and training individuals to transition to a sustainable society

Human activities, as well as occupations in the workplace, need to be carried out in a way that is sustainable and environmentally friendly. Since many human activities in the past have not achieved this, there is a need to adapt the processes in personal consumption as well as in occupations that are carried over from the past, and to develop new sectors of activity to replace environmentally unfriendly alternatives. They are essential to create a more sustainable society: for instance, developing skills and promoting the study of technologies that lead to avoiding as far as possible the use of irreplaceable raw materials, recycling waste, minimizing energy use, and avoiding pollution of the environment. The opportunity to develop entrepreneurial learning through vocational education and training could also lead to the creation of sustainable enterprises and social enterprises that work for the common good of the society.

Making TVET input current and relevant for ongoing labour market regulations

There are a large number of TVET graduates working throughout the economy. Many employment sectors are regulated by standards covering their operations, and many jobs have defined skills standards. Individuals typically undertake TVET with the aim of obtaining the skills level or qualifications needed for regulated occupations, or jobs for which standards of competence levels of skills required are clearly established. As well as regulations covering personnel qualifications, much economic activity is governed by regulations covering operations more widely (although to a degree that varies between countries and sectors). Unfortunately, many existing regulations and standards date from an era before the need for sustainability was fully appreciated, and have not yet been fully updated to meet the requirements for a transition to a green economy. They may even help to maintain a 'business-as-usual' mode of operations, work processes and methods, when this is patently not sustainable, using raw materials, creating waste and emissions, to a degree that causes unnecessary harm to the environment.

The opportunity to develop entrepreneurial learning through vocational education and training could also lead to creation of sustainable enterprises and social enterprises that work for the common good of the society. Many of these enterprises address more efficiently social, human and environmental concerns.

Collective action can be mobilized by establishing green agendas as a norm in an institution. Factors preventing or slowing change can be addressed together with a common goal, an enhanced motivation and collective action to demonstrate good practices. This paves the way for developing a new culture and guiding those involved so changes do take place.

Instilling consciousness, motivation to develop a green culture

Staff and students in learning institutions may not have reached the point of understanding what needs to be changed to achieve sustainable development. Even when they appreciate the issues, they may not possess the motivation to be part of a bigger transformational agenda that is possible through a collective movement. It is first necessary to ensure that there is a collective appreciation of the changes in the economy and society that are needed to achieve sustainability. Then it is necessary for them to act corresponding to these changes. Collective action can be mobilized by establishing green agendas as a norm in an institution. Factors preventing or slowing change can be addressed together with a common goal, an enhanced motivation and collective action to demonstrate good practices. This paves the way for developing a new culture and guiding those involved so that changes do take place.

The greening of TVET institutions will not only add value to the normal institutional development process, it will stimulate progress towards a learning and evolving community.

POINTS TO CONSIDER:

TVET has a role to play in ensuring that the knowledge, skills and competencies acquired by individuals will enable them to contribute to the developing green economy, and indeed to pursue sustainable practices in other areas of their lives. A green economy is one 'that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities' (UNEP, 2011). This is crucial if we are to move towards sustainable societies.

Investing in greening TVET

A global momentum has been created following the demonstration of political commitment to the Sustainable Development Goals (SDGs) and climate-change agreements. The political as well as environmental imperatives for the transition to a green economy are evident. However, the economic and social imperatives of these transitions need further exploration. Is there a solid basis for investing in the greening of TVET?

Knowledge is only one aspect of education and training. Often equally important are wide-ranging skill sets that go beyond the specific task to include increasing employment opportunities, constructing sustainable lifestyles, and promoting sustainable businesses and self-employment. It is important to note that addressing the wider issues of learners, such as their responsibility for lifelong learning, upgrading their skills and learning workplace etiquette, could also contribute to their feeling of general well-being.

Understanding the core principles of ESD within greening of TVET institutions, the reasons for investing in it, the demand for skills and the potential return on investments in TVET, is an important first step in guiding the process.

Several points can be made in explaining why investing in greening TVET is essential. From social and economic perspectives, greening TVET enhances the employability of workers and productivity of enterprises. A worker who possesses knowledge, skills and competencies oriented to green occupations is a more employable worker than someone who does not possess these attributes. In case when there is a shift in job processes, displaced workers can be re-trained and upskilled so they can be employed in other sectors, minimizing the time required for them to find new jobs and enterprises to fill new positions. Moreover, disadvantaged groups in the labour market (young people, women, persons with disabilities, rural communities and other vulnerable groups) require targeted support to develop their potential knowledge and skills for green jobs. Investing in training to help the disadvantaged groups acquire specialized skills will enable their participation in activities linked to transitioning to green economies.

A worker who possesses knowledge, skills and competencies oriented to green occupations is a more employable worker than someone who do not possess these attributes. In case when there is a shift in job processes, displaced workers can be re-trained and upskilled so they can be employed in other sectors, for them to find new jobs and enterprises to fill new positions.

IN SUMMARY

- Greening TVET helps production to advance to more environmentally conscious practices;
- A 'green' worker is a more employable worker; a 'green' workforce will enhance the profitability of the enterprise;
- National governments need to seize the potential for job creation by providing skills needed in the new green sectors;
- Disadvantaged groups in the labour market (young people, women, persons with disabilities, rural communities and other vulnerable groups) require targeted support to develop their potential knowledge and skills for green jobs.

Source: UNESCO-UNEVOC (2012)

Skills and environmental considerations for greening TVET

In different sectors served by vocationally skilled and qualified workers, there are important actions to consider. For example, a weak focus on the environmental issues of jobs may even help maintain a 'business-as-usual' mode of practice, process and method when it is evidently not sustainable. A lack of an adequately trained workforce could create a potential skills gap or skills shortage. Actions to address these issues rely on effective planning of education and training.

TABLE 1
Key considerations for greening the TVET agenda to enable sustainable practices in sectors served by a vocationally skilled and trained workforce

ENERGY SECTOR

Why is this sector a threat?

The energy sector accounts for roughly two-thirds of all anthropogenic greenhouse gas (GHG) emissions, which occur at a level that has been boosted by industrialization and economic growth. Energy is a cross-cutting sector that affects transportation, buildings and industry. Any means of energy production has an impact on the environment, which encompasses issues such as land use, waste production, and disturbance to flora and fauna. Therefore, it has a significance for both the economy and nature conservancy. These effects need to be addressed if we are to attain a sustainable energy sector. Since fossil fuels are a finite resource and their use has contributed greatly to climate change, renewable energy sources are regarded as a generally preferable alternative. There is also a need to control overall energy usage and improve the efficiency of both production and use.

Key environmental issues:

- Responsible for two-thirds of GHG anthropogenic emissions;
- Land use changes;
- Pollution of air, soil and water during the construction and operation phases of energy projects;
- Waste production.

TVET response:

Individuals should be trained who possess:
- technical knowledge for application of energy-efficiency measures;
- technical knowledge for application of renewable energy technologies;
- upgraded skills for emergent energy markets.

Sources: IPCC (2014), IEA (2015)

IRON AND STEEL SECTOR

Why is this sector a threat?

The iron and steel sector causes significant pollution to air, soil and water. Emissions are generated mainly from material handling and discharges of chemical substances or pollutants originating from coking plants. If industrial practices and emissions are not monitored or regulated to environmentally safe levels, they contribute to atmospheric pollution and other forms of polluting emissions.

Key environmental issues:

Harmful emissions:

- Air: chemical compounds and emissions;
- Water: process water containing organic matter, oil, metals, suspended solids, benzene, phenol, acids, sulfides, sulfates, ammonia, cyanides, thiocyanates, fluorides;
- Soil: slag, sludge, sulfur compounds, heavy metals, oil, grease residues, salts.

TVET response:

Technicians and professionals should be trained following an established code of practice or adjustments in environmental standards and job sector regulations over a period of time, in:

- efficient use of energy and resources in industrial production;
- controlling the material cycle;
- energy-efficient applied technologies.

Source: Doushanov (2014)

MANUFACTURING SECTOR

Why is this sector a threat?

Manufacturing production methods may release significant amount of pollutants that are harmful to the environment. Standard ways of producing and processing materials, including textiles, rubber, wood pulp, paper, chemical fertilizers and iron and steel, do not always comply with the highest environmental standards. These processes can therefore affect the environment.

Key environmental issues:

- Ways of obtaining raw materials and resources;
- Resource and waste management;
- Product design with low value.

TVET response:

A trained workforce is needed with the knowledge and skills required to enforce the highest environmental standards and practices throughout the value chain, including:

- raw material collection;
- pre-processing;
- production;
- distribution;
- trade (marketing);
- sustainable crafts/business and product development.

Source: UNIDO (2013)

CONSTRUCTION SECTOR

Why is this sector a threat?

The construction sector is one of the main sources of environmental pollution worldwide. It accounts for 30 per cent of energy-related GHG emissions, 40 per cent of total waste and 12 per cent of water use. The building sector consumes approximately 60 per cent of the world´s electricity, an amount which could be reduced by 30–80 per cent through energy-efficient interventions. Additionally, the construction sector employs 10 per cent of the workforce and is estimated to be worth 10 per cent of global GDP. Considering the rapid population growth and urbanization worldwide, this sector has a significant worldwide importance for the economy, the job market, exploitation of resources and pollution.

Key environmental issues:

- High GHG emissions;
- High consumption of raw materials and resource depletion;
- Land use change;
- Waste production and pollution.

TVET response:

A trained workforce is needed with the knowledge and skills required to enforce the highest environmental standards and practices throughout the sustainable construction process, including:

- sustainable building design;
- sustainable building technologies and construction materials;
- water supply and sanitation;
- decentralized electricity generation and the integration of renewable energy generation methods into buildings;
- energy efficiency in buildings;
- solid waste treatment;
- reuse of materials and controlled demolitions.

Sources: UNEP (2010), UNHABITAT (2012)

AGRICULTURAL SECTOR

Why is this sector a threat?

The agricultural sectors consume approximately 2 per cent of global energy demand, and account for 38 per cent of land use worldwide, contributing significantly to GHG emissions. Recent research indicates that reformed agricultural practices will help to achieve 21–40 per cent of the emission-reduction target by 2030. Irrigation has been a key method in producing enough food for people, and today it accounts for 95 per cent of total world water withdrawal. Considering that by 2030 food production has to be increased to feed 3 billion more people, increased competition with domestic and industrial use of water is foreseen. The extensive use of fertilizers and pesticides causes significant pollution of the natural environment.

Key environmental issues:

- Inefficient energy consumption;
- Land use change and expansion of agricultural frontiers;
- Lack of technical and political instruments so that emission reductions targets are reached;
- Inefficient water use through irrigation;
- Pollution of the environment through the use of fertilizers and pesticides.

TVET response:

Trained individuals in the field of agricultural production should provide:

- technical knowledge for new practices like organic farming and agroforestry;
- technical knowledge for the application of energy-efficient technologies in the agriculture sector;
- efficient use of water and irrigation technologies;
- use of information and communication technology (ICT) in agriculture.

Sources: FAO (n.d.), FAO et al. (2014), White (2016)

FOOD SECTOR

Why is this sector a threat?

Food processing can be divided into four major sectors: fruit and vegetables; meat, poultry and seafood; beverages and bottling; and dairy operations. All of these sectors consume huge amounts of water for processing. A considerable part of this becomes wastewater that must be treated for safe disposal before being returned to the environment.

Key environmental issues:

- Wastewater: issues include biochemical oxygen demand (BOD); total suspended solids (TSS); excessive nutrient loading, of nitrogen and phosphorus compounds; pathogenic organisms resulting from animal processing; and residual chlorine and pesticide levels.
- Solid waste – includes both organic and packaging waste. Organic waste includes the rinds, seeds, skin and bones from raw materials, and waste from processing operations. Inorganic wastes typically include discarded packaging items consisting of plastic, glass and metal.

TVET response:

Training a qualified workforce to support processes of:

- advanced wastewater treatment practices;
- improved packaging;
- improved sensors and process control (to reduce waste and improve productivity);
- food irradiation;
- water and wastewater reduction using closed loop/zero emission systems.

Source: UNIDO (n.d.)

Transforming TVET for meeting the needs of a greening economy and society

The greening of economies is causing unprecedented shifts in skills requirements. These changes include shifts in the ways in which jobs are performed (which lead to a need to retrain and upskill displaced workers so they can be employed in other sectors); the emergence of new skilled occupations (for which individuals need to be trained and acquire qualifications); and the greening of existing jobs (which also demands upskilling of those employed) (Strietska-Ilina et al., 2011). Achieving a green economy requires much more integration of skills and employment development policies into a green economic agenda. In some cases, there are skills shortages as a result of people reaching retirement age without new individuals having been trained to replace them; the small number of trained and qualified personnel available; or a lack of specific skills and competencies which hinders technological and market-related expansion.

Transitioning to a green economy promises access to new jobs, but also creates changes in the scope and character of existing jobs. Without an adequately trained workforce, this scenario will give rise to skills shortages in some sectors even though jobs are available in others.

Skills development strategies that facilitate the transition to the green economy need to:

- adapt to the evolution of employment sectors;
- prepare teachers and trainers who can effectively transfer their knowledge and skills;
- expand the current scope of TVET and delivery mechanisms;
- enable the workforce to adjust to technological shifts.

Essentially, skills development strategies demand a great deal of thought. As discussed in Table 1, the processes, technologies, material flows and their environmental consequences need to be taught to a large number of people who will provide a reservoir of skills. A complete value chain of products needs to be broken down into separate levels where skills and capacity needs can be identified and training provided, and where TVET graduates can be oriented to ample and decent employment opportunities.

It is also foreseen that the greening of the economy will put more pressure on the already complex scenarios of multi-level skills shortages (as described in Box 3) and surpluses. The transition to a low-carbon economy raises at least two challenges related to skill requirements: countries do not have sufficient skilled professionals for green jobs, and there is a demand to retrain those affected by shifts in skill requirements.

Providing access to targeted training for low, medium and high-skilled workers could result in addressing the challenges of skills shortages. These changes could help generate a greater sense of purpose for institutions transitioning to a greener TVET.

BOX 3
SKILLS SHORTAGE VACANCIES (SSVs) AND THEIR IMPACT, UNITED KINGDOM

In Wales (United Kingdom) one in five vacancies (20 per cent) is reported to be in an area with a skills shortage. These skills shortage vacancies (SSVs) tend to be concentrated in specific sectors and occupations. The SSVs have showed a 130 per cent increase over the five years to 2015 (UKCES, 2016). Different types of jobs reflect varying concentrations of skills shortage. As many as 44 per cent of vacancies in skilled trade occupations were the result of skills shortages in 2013. The UK Commission for Employment and Skills defines 'skilled trades' as jobs that require practical skills and training, such as electricians, motor mechanics, plumbers and carpenters. This is followed by manufacturing with a 25 per cent vacancy rate. An Employers Skills Survey (UKCES, 2016), which interviewed employers who had difficulty filling vacancies, revealed that skill-shortage vacancies increase the workload for other staff by 84 per cent. They are also associated with business operational bottlenecks, such as difficulties meeting customer service objectives, loss of business to competitors, increased operating costs, and delays and difficulties in introducing new working practices. Meeting quality standards is also a serious consequence.

A global framework for sustainability

A major component in achieving the global vision of achieving sustainability is the creation of more sustainable production and consumption patterns. The greening of TVET institutions is an essential element to achieve this.

The Sustainable Development Goals (SDGs), agreed by 193 world leaders at the United Nations in 2015, are a seventeen-point plan to end poverty, combat climate change, and fight injustice and inequality. They apply to everyone. Every one of the seventeen SDGs and most of their targets will require awareness-building, public/worker understanding, educational programmes or some form of training if they are to be achieved.

In particular, SDGs 4.4 and 4.7 specifically addressed this issue:

4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development (United Nations, 2015).

POINTS TO CONSIDER:

Education and training is key to achieving many of the SDGs. In particular, the greening of TVET is vital to meet these goals, and supports the fulfilment of the other targets of the SDGs. It is equally true that a well-articulated and sustainable development-oriented TVET policy can lead to huge improvements in education and training and living conditions, among other aspects.

FIG. 2
TVET IN THE UN SUSTAINABLE DEVELOPMENT GOALS, PART OF THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

QUALITY EDUCATION

Target 4.3
equal access for all women and men to affordable and quality TVET, including university

Target 4.4
increase the number of youth and adults who have the relevant skills, including technical and vocational skills for employment, decent jobs and entrepreneurship

Target 4.5
eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations

Target 4.7
all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and nonviolence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development

CLEAN WATER AND SANITATION

Target 6.3
improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials

Target 6.4
increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater

DECENT WORK AND ECONOMIC GROWTH

Target 8.6
reduce the proportion of youth not in employment, education or training

Target 8.9
implement policies to promote sustainable tourism that creates jobs and promotes local culture and products

CLIMATE ACTION

Target 13.3
Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

A global action programme on ESD

The concept of ESD is simply that we should utilize the world's existing education and training systems, together with public awareness systems, as an efficient means for implementing sustainable development. ESD is primarily a new purpose affecting our education systems rather than a new discipline to be added. The intention is both to improve the access, retention and delivery of relevant knowledge, skills, values and perspectives; and to reorient our existing disciplines, programmes and outcomes so as to change unsustainable practices at all levels. There are four main thrusts or spheres of activity that comprise ESD:

- increasing public understanding and awareness of sustainability;
- reorienting existing educational programmes to address sustainability;
- improving access *to* and retention *in* quality education through ESD;
- professional development, in-service training courses and training to advance sustainability across all sectors (McKeown et al., 2002).

While TVET is related to all of these spheres of activity, it is in the second and fourth thrusts that the greening of TVET is firmly situated.

The new Global Action Programme (GAP) on ESD draws attention to the role of educational institutions as essential contributors to a more sustainable future. To build on previous achievements and create new momentum when the United Nations Decade on ESD closed in 2014, UNESCO, as the lead agency of the Decade of Education for Sustainable Development (DESD), developed the Global Action Programme on ESD. The programme contributes to achieving the vision put forward by the DESD: 'a world where everybody has the opportunity to benefit from education and learn the values, behaviour and lifestyles required for a sustainable future and for positive societal transformation' (UNESCO, 2014).

The GAP aims to generate and scale up action in all levels and areas of education and learning, in particular TVET. It seeks to multiply and scale up ESD action by integrating sustainable development into education and integrating education into sustainable development.

A key element of the GAP described later in this *Guide* is the need to move beyond teaching about the concept of sustainable development in some subjects to reorienting the whole learning institution so that everyone within the community develops the knowledge, skills and values that will help them to lead and maintain sustainable lifestyles and work in a sustainable economy (UNESCO, 2014).

Greening TVET will contribute in transforming learning and training environments and in building capacities of educators and trainers, while it seeks to take forward other areas of priority to accelerate ESD implementation.

The United Nations encourages colleges, universities and communities to take further steps on ESD and on the new SDGs. Hence, this *Guide* attempts to combine many of these individual initiatives into an integrated approach that, in the long term, will assist leaders of TVET institutions to better serve their graduates, the communities and the TVET institutions themselves.

This *Guide* is designed to help institutions create measures to combine different initiatives in a single integrated undertaking.

In summary, TVET in many countries is an enabler of economic growth and sustainable development. If it is to act as an enabler, TVET providers must be able to produce graduates with qualifying skills that satisfy the needs of employers and the jobs. These graduates are also equipped to adapt to a changing pattern of a more societal nature, for example, changes in consumption and lifestyle that can affect economic

activities. To address these needs TVET has broadened from the narrow task of providing training for industry and occupation-specific skills to the broader task of workforce development, lifelong learning for sustainable development, developing skills for decent jobs and inclusive growth, and responsible global citizenship.

There are five priority action areas to advance ESD (see Fig. 3).

FIG. 3
PRIORITY AREAS OF THE GLOBAL ACTION PROGRAMME ON ESD

PRIORITY ACTION AREA 1

ADVANCING POLICY: Mainstream ESD into both education and sustainable development policies, to create an enabling environment for ESD and to bring about systemic change

PRIORITY ACTION AREA 2

TRANSFORMING LEARNING AND TRAINING ENVIRONMENTS: Integrate sustainablility principles into education and training settings

PRIORITY ACTION AREA 3

BUILDING CAPACITIES OF EDUCATORS AND TRAINERS: Increase the capacities of educators and trainers to more effectively deliver ESD

PRIORITY ACTION AREA 4

EMPOWERING AND MOBILIZING YOUTH: Multiply ESD actions among youth

PRIORITY ACTION AREA 5

ACCELERATING SUSTAINABLE SOLUTIONS AT LOCAL LEVEL: At community level, scale up ESD programmes and multi-stakeholder ESD networks

Source UNESCO (2014)

SECTION TWO

STEP 1:
Understanding the Process

1.1 CLARIFYING THE GREENING CONCEPT	1.2 MAKING AN INSTITUTIONAL ALIGNMENT AND ASSESSMENT	1.3 ADAPTING A WHOLE-INSTITUTION APPROACH	1.4 ENGAGING TEAMS
• A continuing process • Based on economic, social and environmental imperatives • Sustainablility approaches within an institution-wide action	• The local employment needs • Sectorial policies and regulations as drivers / hindrance • National agendas • International commitments	Approaches to integrate sustainability • Greening the campus • Greening the curriculum and training • Greening the community and workplace • Greening research • Greening the institutional culture	• Analysis of stakeholders • Stakeholders as learning partners • Articulated roles and contributions of each stakeholder

1.1 CLARIFYING THE GREENING CONCEPT

Greening as a continuing process

Greening is an emerging and ongoing phenomenon that should become a permanent part of the institutional ethos. The underlying principles outlined in this *Guide* – mainly suggesting greening as a process more than a destination – will become a useful starting point. The ongoing evolution of institutional greening will be an important component of the 'institutional DNA', affecting the consciousness of the staff, learners and graduates, the institute's reputation and its contribution to the community.

The term 'greening' can easily be misunderstood. For the purpose of this *Guide*, greening is regarded as a process of adapting knowledge and practices with the aim of aligning them with the overall concept of sustainability. "Greening" goes far beyond simply what is taught. Greening reaches into all aspects of the institution's operations or enterprises. Greening entails energy, water and waste management as an essential entry level but also extends to purchasing, food services and even human resources policies to penetrate the very culture and societal contribution of the institution. Greening can also enhance decision-making and lifestyle choices in a more ecologically responsible manner that can lead to environmental protection and sustainability of natural resources for current and future generations. Greening is also economically connected as most greening initiatives have financial implications with a positive return on investments. When adapted to educational and training activities of an institution, greening could lead to an incremental and systematic process of change.

Developing an institutional greening concept using an institution-wide approach is guided by the following checklist:

- Is there a vision to anchor ESD implementation in the institution?
- Are there existing or untapped resources to support the process?
- Do institutional stakeholders possess the potential to run a greening campaign or respond to messages of such campaigns?
- Are those involved in education and training equipped with awareness, knowledge and competencies?
- Do external stakeholders know about the institution and its potential?

Greening as a whole-institution approach

The process of greening TVET institutions invites those involved in training and learning to engage in a whole-institution approach. This approach seeks to develop knowledge, skills and attitudes that can lead to more sustainable practices in the community, the workplace and other settings where knowledge and skills could be applied. It can also lead to obtaining professional qualifications or proofs of learning that reflect environment-friendly skills. As a whole, the approach develops enabling capacities that make people active members of green economies, sustainable and climate-resilient societies, and enable them to pursue lifelong and decent work.

Rather than being seen as a final outcome, implementing ESD in TVET is a process that can evolve through time, allowing holes to be plugged effectively as institutions are carried through the process. It should also be possible to look backwards to see whether efforts are working effectively, and to effect change as needed.

Greening education and training should **not** be:

- a one-time makeover for the institution or programme, but rather a process to be incorporated into the very culture of the institution – what might be called the 'institutional DNA' – to be communicated to the institution's immediate community and to be observed and measured over a period of time;
- a 'destination', but rather viewed as ongoing and evolving process as needs and opportunities emerge within the institution, the world of work and society as a whole;
- an add-on accomplishment, but a sense of purpose entrenched in education and training systems. In other words, greening must become an ongoing item within the core framework rather than a one-time success story that can be set aside.

BOX 4
THE GREENING GENOME FRAMEWORK FOR COMMUNITY COLLEGES IN THE USA

The American Association of Community Colleges (AACC) SEED Center initiated the Green Genome Framework designed to help community colleges expand their local green economies by aligning plans with green-focused workforce education programmes. Noting that there is no single route to facilitate community colleges to achieve the objective, the Genome project's approach begins with four institutional competency areas – or DNA strands – needed to achieve transformation: Governance; Programme Design and Delivery; Strategic Partnerships; and Community Engagement.

Source: Cohen and Feldbaum (n.d.)

Based on holistic imperatives: economic, social and environmental

Although the term 'greening' is widely used, it can be misleading when the overall goal is sustainable development embracing social and economic as well as environmental sustainability. Threats arising from social instability, such as religious or ethnic intolerance, are also sustainability issues. Demographic changes, such as the retirement of an ageing workforce, the youth bulge and unemployment patterns, affect sustainability. Social justice issues, racism and exclusion based on an individual's sexual preferences are also included. Economic and environmental activities, such as production and consumption of goods and services, management and maintenance of resource-efficient and renewable energy, and technologies that support sustainability, are also important considerations. While the term 'green economy' has influenced the terminology, it is important to note that UNESCO and the United Nations itself use 'greening the world of work' in a much broader and inclusive context. It is in this broader vision that greening TVET needs to be embraced.

As a whole-institutional multidimensional approach

The whole-institutional approach to implementing ESD in TVET is based on five elements that advance the sustainability agenda. As TVET systems are at different stages of development and TVET is offered in different modes in different countries and sectors,

BOX 5

EXPANDING SKILLS FOR THE GREEN ECONOMY THROUGH GREENING OF FET COLLEGES, SOUTH AFRICA

South Africa has taken an important step to achieve a greener and more prosperous country. The signing of the Green Economy Accord, under the auspices of the Economic Development Department, lays the foundation for increased employment creation and equality, as well as engaging multiple stakeholders, including the government and social partners. The Accord is expected to spur opportunities for South Africans to participate fully in the green technological revolution as a way to reduce dependence on coal-based energy, to develop local industry that includes the necessary technologies, and to create more opportunities for workers and for small businesses and cooperatives. Expanding skills development and training programmes to develop the skills needs for the green economy is at the heart of the interventions. In conjunction with the National Skills Accord, South African education and training authorities and further education and training (FET) colleges are engaged in developing their own plans and projects linked to the green economy. Through the Department of Higher Education and Training (DHET), training programmes linked to the skills needs of the green economy are being expanded and new programmes are taking into account the requirements of the green economy. Retraining and refresher courses are also part of the skills agenda.

In line with this, the greening of FET colleges in South Africa focuses on the development of special green profiles and the integration of green issues into training in selected FET colleges. The greening of colleges is anchored on five strategic dimensions that are embedded in the framework of the college's integrated management system. In collaboration with Deutsche Gesellschaft für international Zusammenarbeit (GIZ) and DHET, several initiatives have been implemented in eleven FET colleges. They aim to:

- support qualified FET lecturers in their continuous professional development through training in renewable energy and energy efficiency technologies;
- develop a new optional vocational subject on renewable energy and energy efficiency technologies for National Certificate Vocational (NC(V)) students;
- initiate various types of greening of FET college activities as essential awareness-raising and cross-cutting themes for sustainable development.

Sources: South Africa (2011), Singh and Feuerrigel (2013)

institutional implementation may vary greatly. So too will an institution's ability to engage in implementing actions relating to all five approaches. Some of these dimensions may not apply in all types of learning setting and condition. The *Guide* then serves as a basis for understanding essential elements that can stimulate optimal, if not holistic, approaches for greening TVET.

1.2 MAKING AN INSTITUTIONAL ALIGNMENT AND ASSESSMENT

An individual TVET institution does not exist in a vacuum, but it is situated in a much larger context. It is important to have a good understanding of the existing mandates and policies within the institution's sphere of influence. Ranging from global to national, to state and to local initiatives, these policies can affect the exercise of the mandate as well as the availability of funding. An awareness of local employment imperatives and student aspirations is a crucial necessity, but so too are knowledge of national sectoral legislation (such as environmental laws forbidding the use of ozone-depleting substances), national strategic agendas (such as green growth strategies, or the stated aim to produce a skilled workforce by 2030) or international commitments (for instance, a country's agreement to an international environmental protocol) on which institutional initiatives could benefit from constructive top-down influence.

The examples presented in Box 5 and 6 show the close alignment of institutional strategies to national and sectorial policy agendas.

Situating a greening institution initiative within an overall national (or sectorial, territorial) agenda can act as a first step to assessing institutional capacities to support this agenda.

The following are helpful questions for this initial assessment:

National goals and sectorial policies on education and skills development, environment, economy

- What policies exist?

If policies do exist:

- What aspects of sustainable development are reflected in the policies?
- Where is TVET placed in the whole scheme of meeting the goals of education or skills development or an integrated education/environment and economic agenda?

To help establish the linkage of institutions to broader policy agendas:

- What is the existing institutional aim?
- Does it pursue specific objectives on sustainability as established in the policies?
- What are the current institution's strengths, weaknesses, opportunities and threats (SWOT) for/against contributing to the formulation of an integrated plan to implement ESD?

If the institution's vision and potential contributions are clearly established:

- What new institutional aims or objectives can be pursued?
- At what scale is an institutional approach needed?

Once its relevance is established and the alignment of an institution's possible approach for a greening intervention is clear, a decision can be made on whether to pursue a whole-institutional greening of TVET or for the institutional approach to be broken down into more manageable projects and incremental steps to solve particular issues. A whole-institutional greening of TVET would depend largely on an existing strategic plan that can be reviewed to reflect the institution's well-defined green-oriented goals.

1.3 ADAPTING A WHOLE-INSTITUTION APPROACH

There are five approaches through which sustainability could be pursued by TVET institutions. It may be necessary to begin by employing a limited number of these approaches, so as to avoid losing sight of the essentials (although this depends on the institution's current situation), and to expand the range employed according to the availability of resources.

BOX 6
FULFILLING 'MAURICE ILE DURABLE' THROUGH EDUCATION AND TRAINING, MAURITIUS

The government's vision is to make Mauritius a model of sustainable development, particularly in the context of small island developing states (SIDS). 'Maurice Ile Durable' (MID) is a shared vision involving the government and different stakeholders to promote a sustainable development culture in Mauritius. One of the key priority areas for action is education and training. Skills, knowledge and understanding are core cross-cutting pillars for MID delivery. They link social well-being and inclusion through environmental protection and enhancement to economic development.

The Mauritius Institute of Training and Development (MITD), in its capacity as an enhanced provider of training, fulfils this by playing a vital role in reorienting TVET in Mauritius to support the transition towards sustainable development by promoting green skills. It has recognized the need for redesigning existing training programmes so as to integrate competencies relevant to sustainable development, leading to the greening of existing jobs. Similarly, developing new training programmes for capacity-building to respond to the requirements of emerging green jobs is a basis for aligning MITD's agenda with that at the national level.

Source: Cohen and Feldbaum (n.d.)

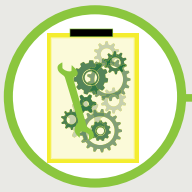
The five approaches to sustainability in TVET institutions

The following discusses the important approaches to pursue sustainability in TVET institutions and the conditions that lead to adapting them in a particular setting. Each of the approaches are supported by examples of tools and instruments that can be consulted or reviewed in order to initiate concrete interventions on the part of the institution.

FIG. 4
FIVE APPROACHES TO SUSTAINABILITY IN TVET INSTITUTIONS

1 GREENING THE CAMPUS

Aims to promote an integrated management of the campus to strengthen operational sustainability mechanisms. It is designed to see sustainability principles are applied; resources are deployed; and financial returns and benefits for the institution are established.



2 GREENING THE CURRICULUM AND TRAINING

Aims to integrate sustainability into the existing curriculum and training. It seeks to embed environment-related contents and green skills in the curriculum and training. In the process, teachers and trainers are progressively equipped with competencies they need to deliver relevant contents across disciplines or in a specific area of competence.

3 GREENING RESEARCH

Aims to promote and apply sustainability in research philosophies, content, ethos and standards. It is in this approach that institutions can engage in collecting and disseminating data that are useful for the learning community. Actors in the institution seek to investigate applications of sustainability practices and develop solutions together.

4 GREENING THE COMMUNITY AND WORKPLACE

Aims to co-develop and implement with enterprises and communities the institution's sustainablility plans and programmes in which shared goals can be pursued, and sustainable practices in the workplace and sustainable lifestyles become the norm.

5 GREENING INSTITUTIONAL CULTURE

Aims to embed sustainability into all aspects of the institution. Greening culture is where sustainable development could be an integral part of all the strategies and plans of an institution, the benefits are demonstrated by the stakeholders, and are evident in a range of institutional outcomes.

Sustainability approach 1: GREENING THE CAMPUS

Aim: Managing the campus to strengthen operational sustainability mechanisms

The term 'campus' refers initially to greening a broad range of physical features – buildings, landscape, maintenance procedures and campus services. The initial goals are often to reduce the costs associated with resource usage such as energy, water and waste, and to reduce and better manage the institution's GHG footprint. The savings achieved are then often used as the means for funding the overall greening plan within an institution.

The procedure involves adapting institutional operating goals and methods so as to improve the overall efficiency, conformity and costs in running the institution. These economies may be achieved through adapting facilities to conform to new building standards (or code of practice) for energy efficiency, or enhancing the environmental conditions and aesthetics of the grounds while reducing water resource use.

As well as the buildings and their maintenance and procedures, other services such as food, procurement and transportation are usually seen as integral parts of greening the campus. Greening also entails making the campus a better place to live and work, with good air quality and daylight to facilitate learning processes and improve learning outcomes, a safer place for the members of its community, and/or making the campus more accessible for students with disabilities. Greening the campus is all about creating an institution that can become a model of sustainable living and an inclusive laboratory of ideas, skills and innovations for sustainable development. It also represents a place where sustainable, healthy and safe conditions exist, which improves the opportunity for students – of all social groups, religious beliefs and genders - to learn technical skills and obtain the knowledge, skills and attitudes that lead to formal qualifications, and help them to achieve sustainable work and a sustainable lifestyle.

Outcomes

- Sustainability principles are applied in the institutional structures, philosophies and services, learning processes and physical site;
- Resources are deployed to support an institutional green movement;
- Financial returns and status benefits for the institution through cost savings, improved facilities and institutional development.

Helpful tools

- Physical site: calculation tools for measuring energy and water efficiency; carbon footprint, energy and cost-savings; food waste guidelines; waste management guidelines; transportation and procurement guidelines, building codes;
- Non-physical aspects: guidelines for gender integration and gender sensitivity, inclusion guidelines; campus sustainability guidelines.

Resources

- Campus sustainability practices *http://www.mass.gov/eea/docs/eea/lbe/lbe-campus-sustain-practices.pdf*
- New energy for campuses *http://community-wealth.org/sites/clone.community-wealth.org/files/downloads/tool-apollo-campus-energy-saving.pdf*
- Student power scheme guide *https://ec.europa.eu/energy/intelligent/projects/sites/iee-projects/files/projects/documents/mobilise_energyaware_student_power_scheme_guide_en.pdf*
- Waste management and recycling *http://www.georgebrown.ca/about/sustainability/waste-management-and-recycling.aspx*

Sustainability approach 2: GREENING THE CURRICULUM AND TRAINING

Aim: To integrate sustainability into the existing curriculum and training

As well as greening the campus, it is also crucial to address what is taught to the students in both institution-based and work-based settings. 'Greening' the mind is facilitated through identifying the short-term skill needs and the changes over time that will prepare students to play a role in a dynamic and greening economy. Correspondingly, it entails adapting relevant contents and training so that knowledge and skills are imparted that satisfy the needs of current structures, technologies and job tasks in the labour market. It also involves ensuring that the process and outcomes of training are evidence of the acquisition of practical skills that can be used to perform jobs in a more sustainable manner or introduce new concepts for the greening of occupations.

In every discipline, there is an opportunity to contribute to a basic understanding of sustainability and its importance for the future. This greening of the curriculum should not be limited to environmental

issues alone, but should also address social and economic aspects, and their skills implications. How learners progress through learning for sustainability can be supported effectively by career guidance and the development of upskilling programmes to promote the alignment of skills with the needs of the economy.

What is developed in the curriculum has expanded considerably over time. This *Guide* adapts UNESCO's definition of curriculum, which is a systematic and intended packaging of competencies (i.e. knowledge, skills and attitudes that are underpinned by values) that learners should acquire through organized learning experiences both in formal and non-formal settings. Properly oriented to sustainability contents, objectives and outcomes, this defines it as an effective and organized programme of both theoretical and practical studies, the successful completion of which would lead to achieving educational goals attuned to the SDGs.

Greening the curriculum and training means adapting training disciplines to sustainability concepts and practices in the curriculum used in formal TVET, as well as in non-formal or informal training/learning for young people and adults in a work-based context to enable them to acquire practical skills and participate in green transitions.

Outcomes

- Environment-related contents and green skills development are part of an evolving TVET curriculum and training;
- Teachers and trainers are supported to be competent and develop confidence in delivering relevant contents on sustainability across disciplines;
- Students are equipped with knowledge, skills and competencies adapted to the needs of societies and economies, and that are valued in the world of work;
- Students are well informed and guided through the ongoing process of learning for sustainability.

Helpful tools

- National or territorial curriculum framework; occupation standards, training standards, training needs analysis, analysis of green skills demand, ESD integration frameworks, teacher competency standards.

Resources

- Assessing sustainability learning outcome *https://flemingcollege.ca/PDF/Sustainability/AssessingTheSustainabilityLearningOutcome_June2016.pdf*
- Sustainability curriculum audit *https://cassidyinview.files.wordpress.com/2013/06/sthle2014_researchposter_final_15april2014.pdf*
- Grades 9 to 12 Sustainable Energy Manitoba Technical-Vocational Curriculum Framework of Outcomes *http://www.edu.gov.mb.ca/k12/cur/teched/sytep/sust_energy/full_doc.pdf*
- Sustainability Curriculum Framework *http://www.environment.gov.au/system/files/resources/9b2e74ca-c909-4d57-bae3-c515c20957de/files/curriculum-framework.pdf*
- Methodology for Understanding and Reducing Project Environmental Footprint *https://www.epa.gov/sites/production/files/2015-10/documents/methodology_0.pdf*
- Pilot projects in VET for Sustainable Development *https://www.bmbf.de/pub/Sustainability_in_Everyday_Working_Life.pdf*
- Framework for SDGs *https://www.thecommonwealth-educationhub.net/wp-content/uploads/2017/01/Framework_for_SDGs_Jan_2017.pdf*
- Indigenous perspective curriculum *https://department.flemingcollege.ca/aboriginal/indigenous-perspective-curriculum/*
- Greening of construction curriculum *https://www.palmbeachstate.edu/programs/TradeIndustry/documents/GREENING_OF_OF_CONSTRUCTION_CURRICULUM.pdf*

Sustainability approach 3: GREENING RESEARCH

Aim: Using and applying sustainability in research philosophies, content, ethos and standards

Greening research is, and must be, an integral component of the institutional culture. As well as investigating concepts, beliefs and theories on how to better manage the greening of operations, products, student/trainee/community outcomes and the correction of unsustainable patterns of consumption and production, it stimulates the commitment of both teachers and students to carry out research on matters that contribute to discovering practical solutions to problems.

Research involves the systematic collection of data that can support students, teachers and communities in reaching where they want to be, establishing and accessing adequate labour market data and information about existing skills and skills forecasts that can inform decisions and direct learners to a just transition to decent work and life. Apart from identifying research themes, such matters as ethical principles and considerations for undertaking research procedures, and locating appropriate sources of information, are very much part of this process.

Outcomes

- The institution implements sustainability plans and principles based on research data, and disseminates them;
- The institution proactively engages in collecting labour market information and data useful for students, graduates and the learning community;
- Teachers and students are engaged in projects that investigate applications of sustainability practices and develop solutions together;
- The institution applies standards of research ethics responsibly as part of the interdisciplinary implementation of research processes.

Helpful tools

- Research manuals that carry sustainability principles and ethos;
- Labour market trends and analysis;
- Special interest and academic research.

Resources

- The Role of Canadian Colleges and Institutes in Advancing Education for Sustainability in Canada and Overseas *https://www.collegesinstitutes.ca/resources/*
- Green research in urban garden engineering *http://www.p3rd.ca/gbc_garden.pdf*
- Green skills in agro-industrial sector in Kyrgyztan *https://assets.helvetas.org/downloads/130617_greenskills_report_akmena_e_original.pdf*
- ESD in TVET: case in Philippines *http://www.edu.su.se/polopoly_fs/1.204488.1411628990!/menu/standard/file/Elisabeth%20Thienemann%20No.%2027.pdf*
- Green skills in the mining sector *http://greenskills.co.za/wp-content/uploads/2015/07/MQA-Report-Green-Skills-for-Mining.pdf*
- Finland- SD in schools and educational institutions *http://www.oph.fi/download/47720_kekenglish.pdf*

Sustainability approach 4: GREENING THE COMMUNITY AND THE WORKPLACE

Aim: Engaging industries, enterprises and the wider community in the institution's IGP and programmes

Whereas the need for greening commerce has emerged as a top priority in the business world, there is a need to prepare students with the fundamentals of sustainability within the workplace in which they find employment and within communities where skills are valued as an integral part of local or community-based development. While greening the curriculum for work-based learning emphasizes what is taught to students or employees in a work-based setting, the 'greening of the workplace' focuses on what TVET education can contribute to influencing the greening of work environments or businesses. In simple terms, this means promoting practices that contribute to reducing the environmental impact of business practices and, where possible, jointly developing sustainability programmes and projects to address local issues.

Adapting greening to corporate structures and business development is as important as embedding sustainability in the operating norms of enterprises. Greening the community and the workplace cannot happen without development of local skills and resources that can grow sustainable local markets and enterprises.

Outcomes

- The institutional community contributes to sustainable lifestyle, consumption and production;
- The institutional community preserves the deep-rooted sustainable practices of local and indigenous communities;
- Sustainability projects involve school communities and partners;
- The institutional community develops networks of partners in the business community, local enterprises and industries and explores applying the principles of achieving a circular economy;
- The institutional community is empowered to influence others in the community and the workplace.

Helpful tools

- Community or municipal development plans; community-wide and socio-civic projects; company CSR projects;
- Knowledge on indigenous community practices mainstreamed in teaching resources and curriculum;
- Training regulations; training acts; apprenticeship frameworks and related guidelines; training levies;
- Skills sector projections of future skills.

Resources

- The greening of registered apprenticeship *https://www.doleta.gov/oa/pdf/Greening_Apprenticeship.pdf*
- Canadian Plumber Water Sustainability Training Pilot Project *www.allianceforwaterefficiency.org/WorkArea/DownloadAsset.aspx?id=8843*
- Sustainable manufacturing: Facilitator's Guide *https://www.epa.gov/sites/production/files/2015-02/documents/module_3_facilitators-guide.pdf*

Sustainability approach 5: GREENING THE INSTITUTIONAL CULTURE

Aim: Embedding sustainability into all aspects of the institution

It is the practices and culture on campus that set the tone and expectations of all those who work at and learn in the institution. The very ethos of the institution should correspond to the curriculum, the overall institutional greening plan (IGP) and other initiatives within this plan. This will reflect the institutional vision through hiring and promotion procedures, evaluation schemes, rewards and celebrations, and should also be present in the everyday behaviour of the managers, the teaching personnel, other workers and students. This should eventually become part of the institution's branding and reputation, making it easier for graduates to attain better jobs, while better serving the community's citizens and enterprises.

Outcomes

- The pursuit of sustainable development forms part of all institutional strategies and plans;
- Sustainability skills and principles are applied in day-to-day life and decision-making, including interactions with institutional stakeholders;
- Newly acquired knowledge, skills and competencies enhance professional practice, work processes and methods;
- The institutional culture is underpinned by values and ethics consistent with sustainable development.

Helpful tools

- Strategic plans; monitoring and evaluation tools;
- Tracer studies for graduates;
- Promising practices on greening TVET.

Resources

- The Role of Canadian Colleges and Institutes in Advancing Education for Sustainability in Canada and Overseas *https://www.collegesinstitutes.ca/resources/*
- Embedding sustainability in organizational culture *http://nbs.net/wp-content/uploads/Systematic-Review-Sustainability-and-Corporate-Culture.pdf*
- Community College green framework *http://theseedcenter.org/Special-Pages/ACC-151-Green-Genome-Report(sm)1-17.pdf*
- College House sustainability living guide *https://www.sustainability.upenn.edu/sites/default/files/RA%20GA%20Sustainability%20Manual%202013-2014.pdf*
- Greening universities toolkit *https://wedocs.unep.org/bitstream/handle/20.500.11822/11964/Greening%20University%20Toolkit%20V2.0.pdf?sequence=1&isAllowed=y*
- Green skills and lifestyle guidebook *http://unesdoc.unesco.org/images/0024/002456/245646e.pdf*

It is appropriate to assign short-term, medium-term and long-term goals for each of these activities. This procedure is best carried out through a review of the scale of the greening of TVET, and can be aligned with a concrete roadmap for greening.

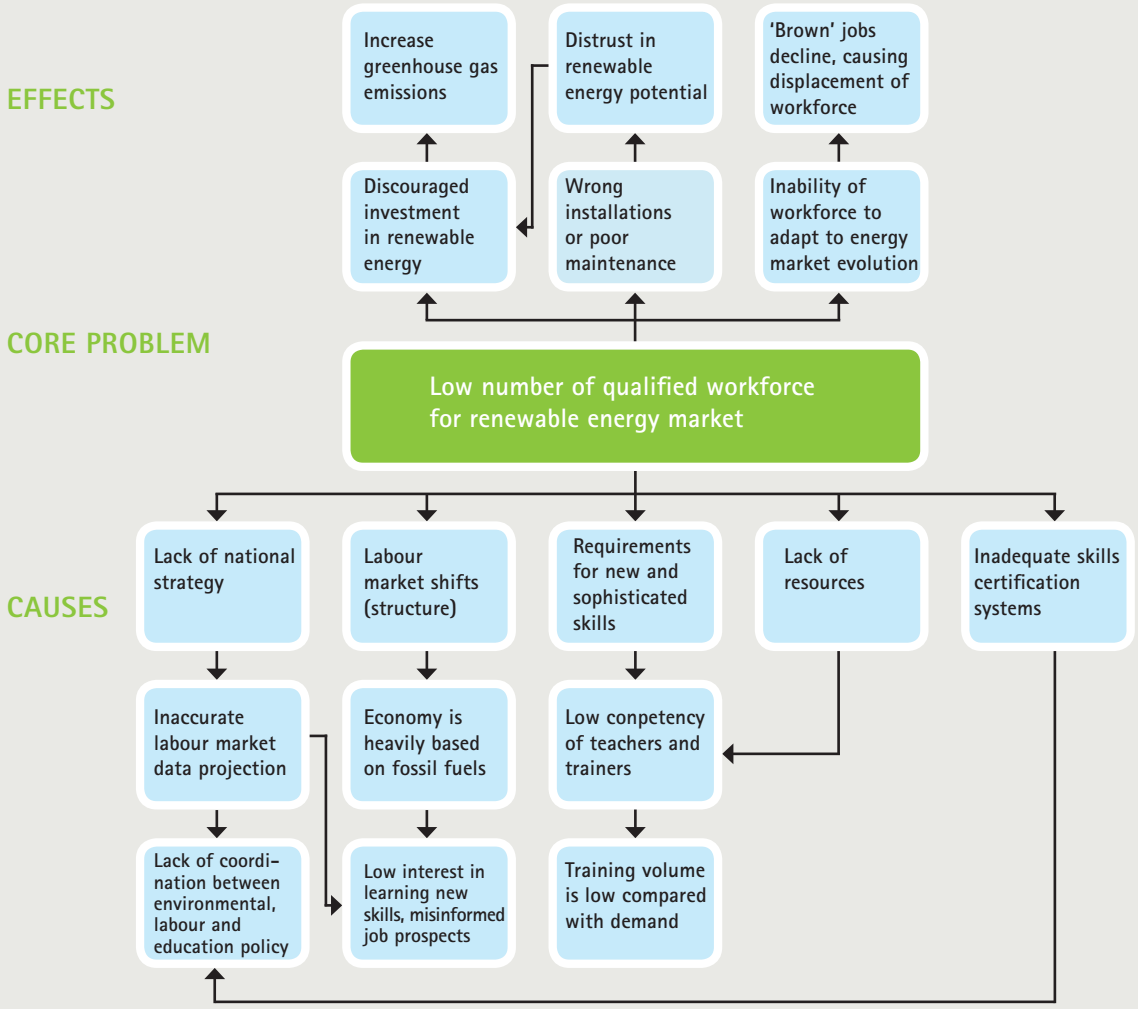
Perhaps one of the more important pillars is culture. It is this pillar that could be adapted as a guiding mechanism for the greening process. A strong basis of green values and ethics, combined with knowledge, skills and competencies, is an important foundation for social transformations that will affect all other sectors, such as the economy and the environment.

This greening culture must permeate the entire personnel of the institution, from the most senior administrator to new recruits. The culture must be understood, consistent and prominent in both policy and practice.

Managing a project assessment approach

When starting a smaller unit-wide or project-based approach, it is useful to conduct a further analysis of specific issues or the problems the unit/project/institution would like to address or contribute to solving. Institutions that wish to begin by taking

FIG. 5
AN EXAMPLE OF A PROBLEM TREE ANALYSIS IN SKILLS DEVELOPMENT IN THE FIELD OF RENEWABLE ENERGY



Problem tree analysis assists in identifying causes and effects of a core problem, broadening the understanding of the context, and grasping the interrelationships and root causes of the problem.

It is useful for designing small greening TVET actions that could have greater impacts on targeting sustainability goals.

Source: authors

an incremental step to greening may carry out an analysis of a local problem to inform and inspire the greening process.

An example of a method for carrying out initial greening project planning is problem tree analysis.[1] This method is ideal for institutions with an established institutional capacity to address key issues and with a clear perspective on alignment of the institutional mandate.

Further problem trees can be viewed at: *www.ilo.org/wcmsp5/groups/public/@ed_dialogue/@sector/documents/meetingdocument/wcms_161134.pdf*

1.4 ENGAGING TEAMS

The need for broad engagement

While the scope of the greening process is huge, it is a task in which all participants (including students, teachers/trainers and school managers) can become engaged as learning partners. A strong team-based approach is associated with an informed role and interlinked responsibilities.

There are common features associated with the greening of institutions, but each site will have its individual characteristics. The current approach is to present the concept of sustainability and the various needs for action to all staff. The challenges inherent in pursuing sustainability, and the concepts, are also presented. Once understanding and the need to act are established, it is then possible to identify the existing capability within the individual system.

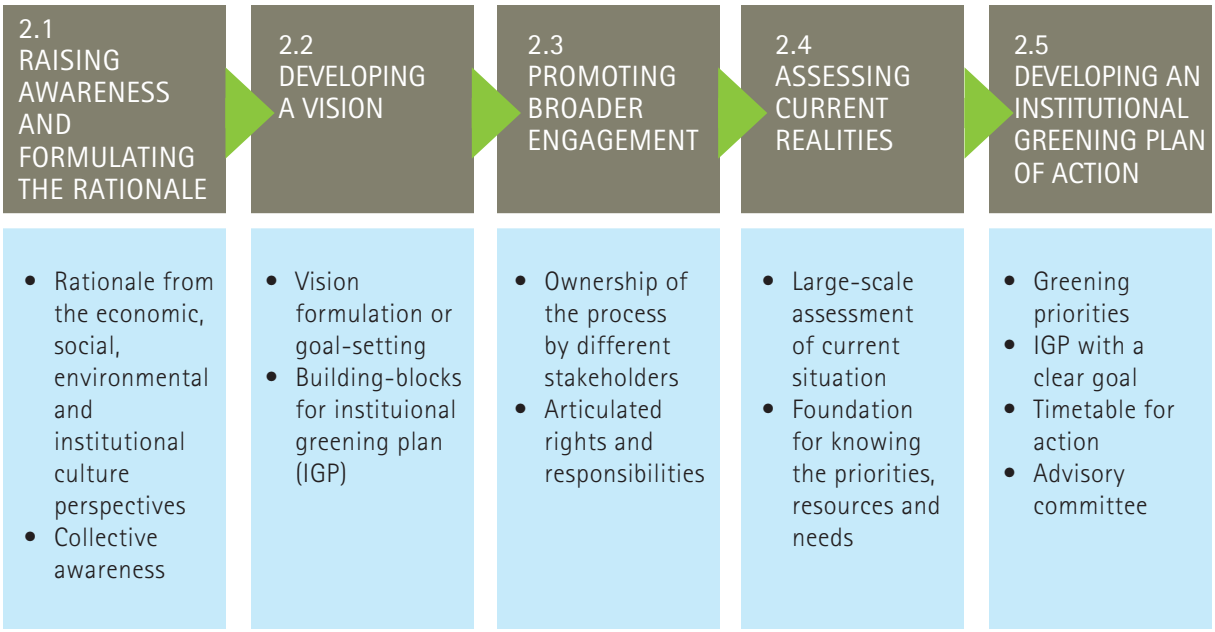
In other words, there is a need to invite team members, learners and business partners to participate on a journey towards a bright, sustainable future. There is a need to understand this ongoing journey as one that has a higher goal, that brings a better quality of life to many and that can be fun – with learning experiences for all while serving the common good.

PREPARING FOR STEP 2

Now that Step 1 is completed, there is an understanding that the greening of TVET includes not only teaching about SD, but also understanding and applying the concept of SD. It means using the whole-institution approach to actually 'live' according to the principles of SD and reflect this in the day-to-day functioning of systems. It is about practising sustainability across the entire learning environment – meaning the campus, policy, practice and even examination criteria. 'Transforming learning and training environments' concerns not only managing the physical facilities more sustainably, but also changing the ethos and governance structure of the entire institution. In teaching for sustainability staff and students see, understand and participate in advancing the greening process while learning and practising transferable principles and skills that can be used in their future workplaces. These need to be identified at the planning stage, in which crafting an IGP will be of great use.

1 There are other methods for analysing existing situations and an organization's own internal and external capabilities and environment. These methods are based on generic principles although they have been applied mostly in the corporate sector. Those that are adaptable to institutional settings include PESTLE analysis and 5Cs analysis.

STEP 2:
Planning for the Greening of TVET



Now that the process of greening TVET is understood, the next step is to begin constructing an overall plan that includes medium and longer-term goals and targets. However, to reorient an entire institution towards better serving students and their communities requires a great deal of thoughtful planning and preparation. Institutions that fail in their first attempts because of a lack of communication or consultation often create ill-will with staff and students, making subsequent attempts much more difficult. While each institution is unique, here are some of the actions or products to be considered in crafting an IGP that represents an integrated response for greening the institution.

First and foremost is the need to identify the lead participants within the institution (the core team) who will assume an initiating role to facilitate the process. They are ideally those who can embody the collective strength that the institution projects, and their tasks will include establishing and disseminating a rationale for the process.

2.1 RAISING AWARENESS AND FORMULATING THE RATIONALE

Establishing a rationale for a whole-institution approach may be the most important step. Without this rationale, and unless the staff are all aware of the vital necessity of being involved in the process, it will be hard to embed sustainability in the culture of the institution on a permanent basis. If the core team establish a sense of urgency and help others appreciate the need for change, the staff as a whole will become convinced of the importance of instant action.

The process must be perceived as necessary and as serving the students, the community, the staff and the institution. It must not be seen as serving only the interests of the administration. Lastly, the rationale must then be shared widely.

Formulating the rationale

The institution has now established a clear aim to link the greening process with the national agenda. Further to the earlier step of assessing external forces (positive and negative), it will be important to conduct a systematic or contextualized analysis of those opposing forces that exist within the institution. The rationale then guides the institution to design its next actions, including the mapping of a clear vision.

Once established, the resulting reasoning for why the institution should embark on greening should be shared and discussed among the different levels of stakeholders of the institution. A sound rationale is often the kind that is well communicated, discussed, improved, to finally reach a collective understanding by the different levels of actors in the institution.

FIG. 6
ESTABLISHING THE RATIONALE – KEY CONSIDERATIONS

Source: authors

BOX 7
INVESTIGATING GREEN SKILLS IN THE MINING SECTOR IN SOUTH AFRICA

A research project carried out in South Africa could help demonstrate how a strong reasoning for developing green skills could be established and informed through analysis of information surrounding an occupation. Institutions can start small projects or training interventions until they are ready to adapt skills development and training strategies to sustainability and increase the scope of environmental aspects of the qualifications they offer. The research is conducted under the auspices of the Mining Qualifications Authority (MQA) in South Africa to inform its decisions and guidance of others on planning for green skills development. The objectives are to determine the green skills needed within the mining value chain, which of these green skills are scarce, the supply chain of these skills and challenges, and factors that influence career pathways.

A contextual analysis of the coal mining industry, one of the several steps made, reveals the drivers for green skills in mining. Other steps are to draw the value chain in the coal mining industry to fully understand the processes, activities and functions involved in the mining enterprise, and consequently determine the green skills components in the sector to make practices more sustainable. These steps significantly look into:

- socio-economic considerations (including aspects of history that still have a strong influence at present);
- policy and legal considerations, including the various mining and environmental laws that apply technological drivers;
- environmental considerations generally and in relation to climate change, air quality and worker health, water, waste and biodiversity.

Source: Rosenberg (2015)

BOX 8
ESTABLISHING THE RATIONALE FOR GREENING TVET IN JAMAICA

Promoting green skills and aligning actions with TVET for sustainable development is an important aim for the greening of TVET initiatives in Jamaica. Led by Heart Trust and the National Training Authority, the rationale for whole-institutional efforts is to be able to equip the learners and workers with the techniques, knowledge, skills and attitudes to ensure sustainable development through conservation, recycling initiatives and renewable energy. Heart Trust/NTA communicated the initiative to several key stakeholders through a series of activities. For example, it organized a seminar to engage several players and stakeholders in Jamaica through this journey.

Source: Heart Trust/NTA (2016)

2.2 DEVELOPING A VISION

There should be a broad understanding of the institution's potential to contribute to existing national policies. Once all the information necessary to determine the direction to be taken has been assembled, the visioning process can begin. All staff members are affected, so at the end of the visioning process people must have a clear understanding of the goal, whether the outcomes were successful and how individual people contributed to the vision. This is also an important step that may require expertise from within the institution or outside it to facilitate the process.

The IGP should be coherent with and embedded within the overall institutional master plan or strategic plan, which should align with other existing and proposed institutional policies, programmes and practices. As established earlier, it is also useful if the institutional plan aligns with other national and international undertakings. This alignment may develop new partners and create a sense of synergy, providing momentum and scale that reinforces the significance of the greening effort. Beyond national and international efforts is the importance of alignment with local industry and other employers. Aligning with these sectors will help with the long-range planning of course restructuring, as well as the planning of new courses needed to better serve students and the community.

2.3 PROMOTING BROADER ENGAGEMENT

The engagement process should begin very early. Leaders who create their own vision and then engage other people to conduct the work will not succeed unless they can adjust and modify the vision so as to give the staff ownership of the process. The board of governors, the management team, the staff, the student body and the community should feel committed to and accept both the rights and the responsibilities in the process. Only with a feeling of participation and a shared voice will the passion be owned.

2.4 ASSESSING CURRENT REALITIES

Before targets, goals, roles and measurement instruments are established, a large-scale assessment of the current situation should be undertaken.

One common change management tool to develop a broad overview is force-field analysis (FFA).

FFA was developed by Kurt Lewin for systematically analysing factors in complex situations. It aids in examining problems through the forces or pressures that support the existing conditions (restraining forces) and those pressures that support change in the desired direction (driving forces). The assessment of organizational systems' restraining and driving forces leads to an understanding of the equilibrium or balance created between opposing forces. The results of assessment can lead to change when the driving force exceeds the restraining force.

In the process, various groups who know their own area of responsibility go through a three-step FFA process (followed by what is effectively the fourth step, of putting the planning into action).

BOX 9
FORCE FIELD ANALYSIS

FFA-1: Ensure that the participants understand and accept the overall vision and goal. This includes the rationale for undertaking and establishing the priority factors. Explain how this would benefit the students, the community and the institution itself. Deliver the proposed timeline in terms of short, medium and long-term goals. Ensure transparency and a feedback mechanism to help fine-tune the actions.

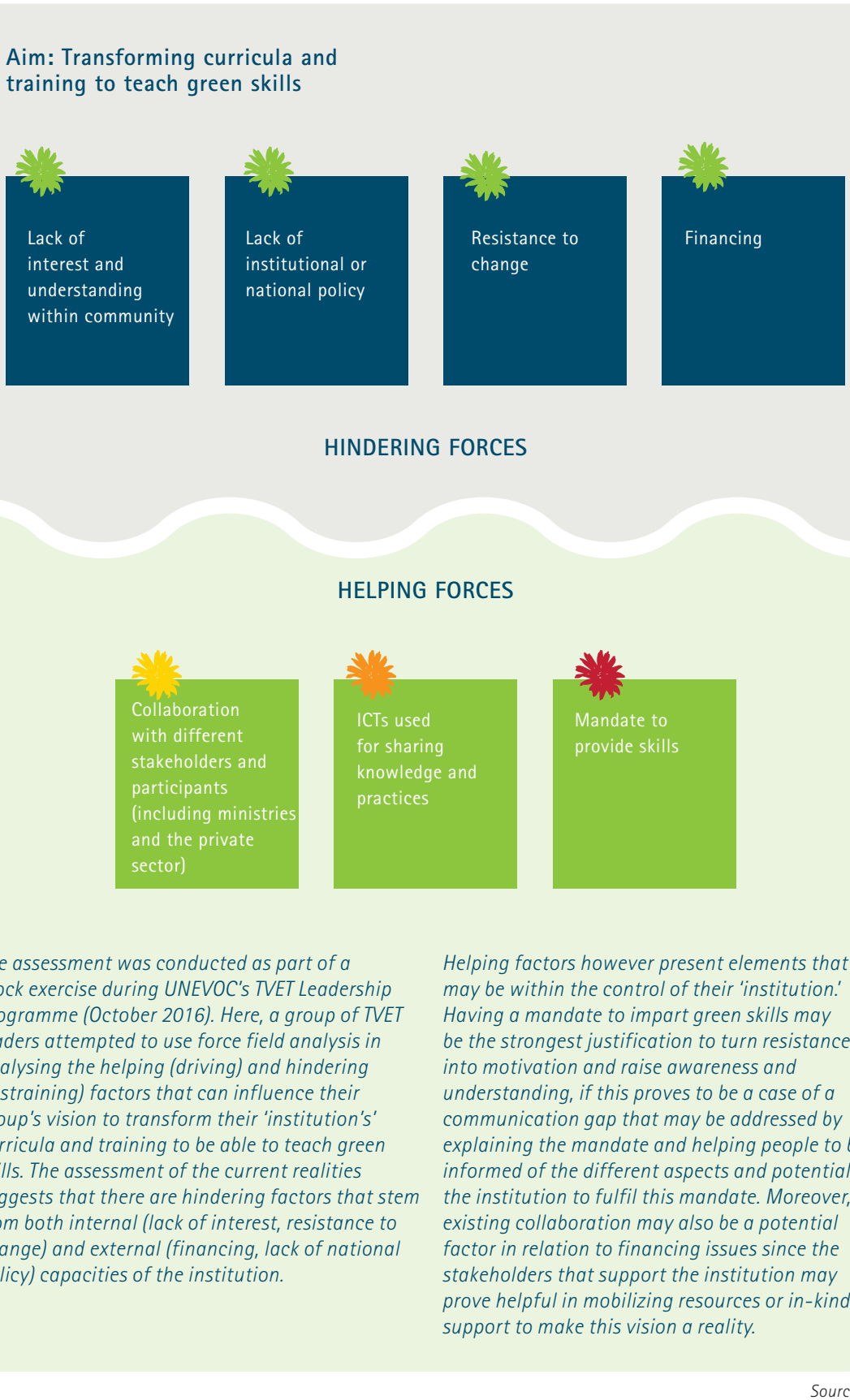
FFA-2: Encourage the team to explore and outline the existing barriers that need to be addressed, as well as the positive components or situations that can be used to help the greening process. It is often useful to hold several of these exercises involving different stakeholder groups or employee sectors. The essence is to engage as many people as possible, to obtain sound insight and advice, and to have everybody – including students and the community – feel committed and that their opinions are respected.

There are many tools for conducting this process. **Figure 7** presents an example using FFA. In this method the aim is placed at the top of the chart. A wavy line is drawn across the middle of the chart, which then separates the negative factors possibly hindering the intended greening from the positive conditions found below the line. The concept is to build as clear a picture of the current reality as possible. All the possible factors both for and against are collected and noted. Issues such as changes in community or employer needs, obsolete equipment, or faculty expertise and/or interest should be listed and entered. Examples of the *hindering factors* are change management fatigue, low community awareness, management system, scarcities of resources, workload (internal) and priorities (external). Some of the possible *helping factors* are leadership's commitment, activities in the community, anticipation of cost savings, new environmental regulations and public demand. These factors need to be analysed to fully understand the balance created by the opposing factors.

FFA-3: The next step is to assemble the various FFAs conducted throughout the institution to create a master assessment of the current situation. This master assessment will be crucial in correctly determining priorities, identifying resources – human, funding, intellectual – and needs, such as equipment or recruitment, that staff and administration feel would contribute to a successful approach.

Source: Dent and Goldberg (1999)

FIG. 7
AN EXAMPLE OF A MASTER ASSESSMENT USING THE FORCE FIELD ANALYSIS METHOD



The assessment was conducted as part of a mock exercise during UNEVOC's TVET Leadership Programme (October 2016). Here, a group of TVET leaders attempted to use force field analysis in analysing the helping (driving) and hindering (restraining) factors that can influence their group's vision to transform their 'institution's' curricula and training to be able to teach green skills. The assessment of the current realities suggests that there are hindering factors that stem from both internal (lack of interest, resistance to change) and external (financing, lack of national policy) capacities of the institution.

Helping factors however present elements that may be within the control of their 'institution.' Having a mandate to impart green skills may be the strongest justification to turn resistance into motivation and raise awareness and understanding, if this proves to be a case of a communication gap that may be addressed by explaining the mandate and helping people to be informed of the different aspects and potential of the institution to fulfil this mandate. Moreover, existing collaboration may also be a potential factor in relation to financing issues since the stakeholders that support the institution may prove helpful in mobilizing resources or in-kind support to make this vision a reality.

Source: authors

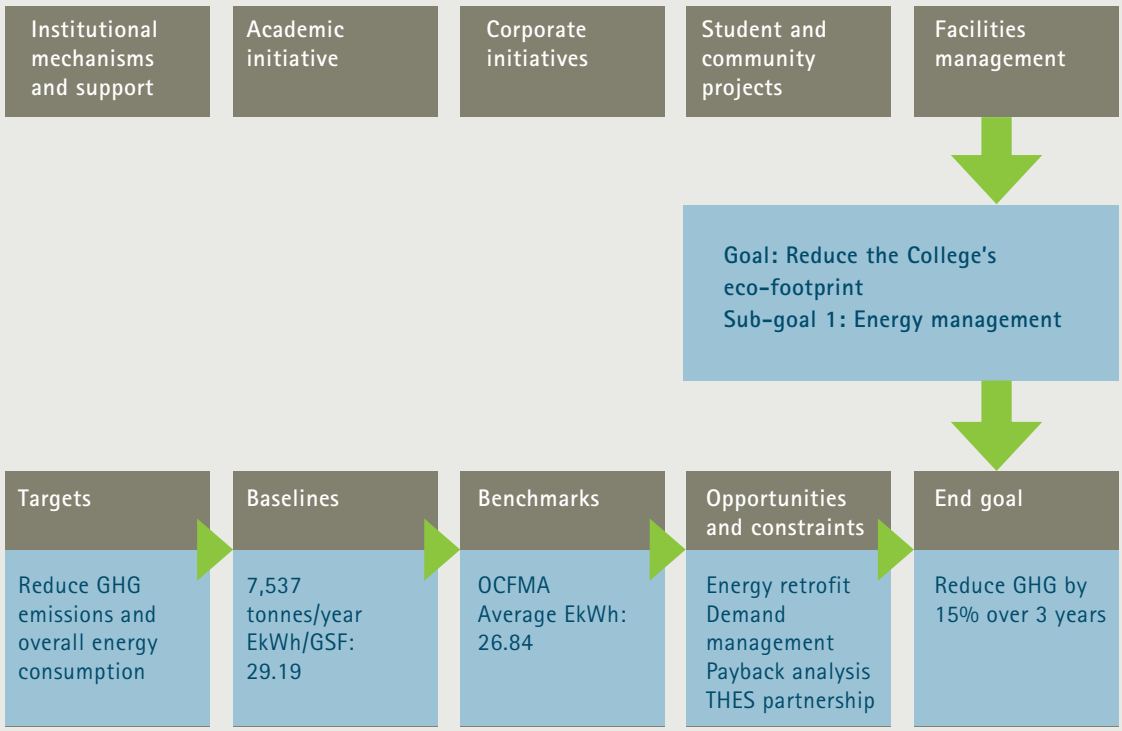
2.5 DEVELOPING AN INSTITUTIONAL GREENING PLAN OF ACTION

Once the FFA has been completed, it is possible to establish priorities and create an IGP. Not all that needs to be done can be undertaken at once. Constraints upon resources, or limitations on the existing policy or staff, will necessitate the establishment of a list of priorities. It is important for staff to understand what the priorities are and how they were established – transparency is important. The IGP should address the short, medium and long-range targets and goals. Funding, accountability and indicators of success are all part of the IGP. The short-term goals are to ensure immediacy and action, while long-term goals provide the guidance and reflect the vision for institutional memory and planning. The IGP should have a specific timetable for review and revisions as necessary.

Greening the campus

Adapting institutional operating goals and methods are often associated with improving the overall efficiency, conformity and costs in running the institution. These economies may be achieved through

FIG. 8
AN EXAMPLE OF A GREEN PLAN FRAMEWORK: GEORGE BROWN COLLEGE, CANADA



George Brown College is a higher education institution that offers technical degree and vocational skills programmes consistent with its aim to produce highly skilled professionals across key disciplines.

In 2008, a green plan proposal had been formulated in which it identified three key outputs: a green plan framework, goals and objectives with measurable outcomes, and a College Green Plan "report card". The framework is organized in five areas. They are institutional mechanisms and support, academic initiatives, corporate initiatives, student and community projects, and facilities management. These areas represent a whole-institution approach to reduce its institutional impact on the environment. The Green Plan Framework provided the foundation upon which subsequent plans were developed.

Source: George Brown College (n.d.a)

adapting facilities to conform to new building standards (or code of practice) for energy efficiency, or enhancing the environmental conditions and aesthetics of the grounds while reducing water resource use. Developing a new conservation plan that established the ways in which the community can benefit is a good starting point to introduce a green campus plan and promote an effective buy-in.

Canada's George Brown College has developed its Strategy 2020 which commits to creating a college experience that enhances student satisfaction by ensuring resources are used as responsibly, ethically and efficiently as possible. The goal is to guide financial and physical resources so that the college can grow responsibly, and enhance the college environment for the benefit of the entire community. At the heart of this strategy is a concrete green plan of action.

Greening the TVET curriculum and training

Integrating sustainability in the curriculum and training is at the heart of the institutional greening process. TVET, as discussed in Section 1, is concerned with providing a reservoir of skills for enterprises that deal with processes, technologies, material flows and their environmental consequences. The economic and employment value of the greening process is high. However, this is only complementary to the social aspects that the greening process must seek to promote in TVET to develop graduates who can be active contributors to the development of an inclusive, competitive, equitable and responsible society.

Many of the outcomes of education and training (e.g., global citizen, qualified professional, critical thinking individual, enterprising individual) that can be measured depend on robust inputs, for example, training designed to transfer knowledge, skills and competencies and enhance mastery of these skills. Greening the TVET curriculum and training needs to take the outcomes into account. Following the skills trends (Strietska-Ilina et al., 2011) in the transition to green economy discussed in Section 1, there are shifts in the ways in which jobs are performed; new skilled occupations emerge; and existing jobs are made more environmentally friendly or adjusted to reduce their ecological footprint.

Integrating additional skills into the curriculum and training will not be an easy task. Therefore, three levels that can support the process need to be considered. What can realistically be implemented can be discovered by investigating labour market needs and demands, considering the environmental sustainability aspects of jobs, and matching those needs with the existing curricula to identify the gaps and decide how best to fill them. Drawing up a

TABLE 2
Three levels to consider in integrating skills

Macro- / Systemic Level	• Introduce new skills into the current institutional programme framework • Additional qualifications on advanced training level • Specialization in selected environmental technology occupations • Economic, social and environmental drivers
Meso- / Institutional Level	• Coordination between industry and TVET institutions • Community or sector demands for skills • Sustainable equipment in training institutions
Micro- / Programme Level	• Teaching and learning media / didactical materials • Training of teachers and instructors • Foundation skills of learners

complete list of the tasks involved in an occupation and their environmental implications would be a good starting point.

Boxes 10, 12 and 12 give examples of approaches to adapting the curriculum and training methods in order to meet:

- the level of demand for sustainability skills in the workplace;
- business sector requirements;
- harmony with vocational qualifications framework.

BOX 10
ADAPTING THE EXISTING DIPLOMA PROGRAMME TO DEVELOP A NEW CURRICULUM IN A POLYTECHNIC IN MALAYSIA

The developments in green technology in Malaysia indicated the need for a workforce able to support them. The case study focuses on a diploma programme in Electrical Engineering (Energy Efficiency) at Politeknik Port Dickson, Negeri Sembilan. The requirement was to identify workplace needs and develop a programme to be offered at diploma level.

A team of researchers carried out 'programme needs analysis' research to justify the programme and identify the knowledge and skills essential for curriculum development. The research started with analysing relevant documents and other sources to determine the need for the programme. These provided the secondary data required. Next primary data were obtained using a questionnaire and semi-structured survey instruments. Three groups of respondents were targeted: potential students, industry and staff. The data were analysed quantitatively, complemented by qualitative analysis. The findings were used to justify the programme to be offered and also provide input to the curriculum development.

The research findings were presented to the decision-making body of the Department of Polytechnic Education for approval before curriculum development commenced. The curriculum developed was presented to the Curriculum Commission so its members could provide input before giving final approval.

Once it had been approved, the department proceeded to source financial allocations to prepare the physical facilities, equipment, and staff appointments and training. In this specific case, the new programme was based on an existing diploma programme, the Diploma in Electrical Engineering (Power), with some essential modifications. The modifications included the following additional elements:

- Energy Efficiency and Conservation;
- Energy Measurement and Instrumentation;
- Renewable Energy (RE);
- Fundamentals of Electrical Utilities;
- Energy Management and Audit.

As a start, the polytechnic was equipped with a combination of windmill and solar panels to generate renewable energy, which was stored in batteries. The power stored was used to light up the corridor of the Electrical Engineering Department at night until dawn. These resources will support the teaching and learning for the programme.

In addition, some of the existing facilities and equipment were shared and new equipment was procured. The main issues and challenges faced involved obtaining the financial allocations and staff recruitment.

Source: UNESCO-UNEVOC (2015a)

BOX 11
INFUSING SUSTAINABILITY COMPONENTS INTO A FIELD-SPECIFIC COMPETENCY CURRICULUM IN GRENADA

Under the CARICOM Education for Employment Program (C-EFE), Canadian and Caribbean institutions implemented the Environmental Sustainability Practices (ESP) Programme and jointly developed TVET programmes linked to the context of moving towards a green economy, mainly for Grenada. To ensure that programmes are demand-driven, the process involved an assessment of social and labour needs through a labour market survey. It also used job analysis workshops to identify and validate the competencies that were later used to develop the curriculum. The workshops relied on multiple stakeholders from the professions, institutions and the public sector with an intensive and theoretical understanding of jobs and the environmental sustainability aspects of those jobs. This process was adopted in view of the present lack of experienced workers in Grenada who could provide full information about the jobs and tasks required. The actual development of the curriculum was carried out in order to link competencies to the curriculum, developing syllabuses and analysing the correspondence of the programme components with the credit systems in place within the lead institution implementing the programme (for example, T. A. Marryshaw Community College in Grenada) and the broader Caribbean educational contexts. The final programmes were also harmonized with the existing vocational qualifications framework through the development of modules. The initiative identified twenty-two competencies and developed twenty-four courses. The programme is based on a multidisciplinary approach where sustainability components are infused into field-specific competencies.

Source: Gagnon et al. (2014)

BOX 12
DEVELOPING STRATEGIES FOR PROGRAMMES AND TRAINING NEEDS AND ASSESSMENT TO REFLECT SUSTAINABILITY SKILLS IN AUSTRALIA

An understanding of the business sector requirements for sustainability is an essential condition for developing a programme that offers a solution to the business need.

A joint initiative of Australian state and territory governments called Skills for Sustainability provides guidance to Australian registered training organizations for developing customized programmes and developing a training and assessment strategy.

Customizing programmes

There are important decisions to make in developing a customised programme. They require in-depth knowledge of the available options balanced with an understanding of the business and skill needs. Among the issues to consider in decision-making for training organizations are:

- Gaining a depth of understanding of the application of the qualifications at the different levels and the skills and job roles they target;
- Identifying whether a whole qualification or skills cluster is the best fit;
- Deciding whether the skills needs align to a sustainability qualification or whether sustainability units should be added to a technical qualification;

- Understanding and selecting the most suitable units of competency for the business needs;
- Checking that your programme meets the qualification packaging rules including any pre-requisites;
- Knowing what aspects of a unit of competency can be contextualized and how to go about it.

Training and assessment

This strategy aims at helping stakeholders in planning and documenting key aspects of programmes such as the content of the programme, how the training and assessment is organized and stakeholders are involved.

The guidance is based on the notion that there is no set way to design or structure training and assessment strategies. However, any such initiative is to ensure that:

- There is a structured approach to planning and delivering training and assessment;
- Training and assessment meets all requirements of the relevant unit/s of competency;
- The amount of training and how it will be scheduled is defined;
- Training and assessment is relevant to the industry and workplace and addresses relevant business needs;
- There are systems and documentation so that everybody who needs to know is clear about how the programme is to run, who is involved;
- Sufficient of the right materials and resources will be available where and when needed;
- Consistent high-quality delivery and assessment will be provided to the client.

It further indicates that not all strategies are going to be the same. The training and assessment strategy will vary depending on whether programmes are aligned to a full qualification or a skills cluster (group of units of competency). Client groups will have different learning needs. The operational requirements of industry clients and changes to legislation or regulation in the industry will also have to be taken into account as factors that can affect strategies.

Source: MSA (n.d.)

Greening the community and the workplace

There is a need to prepare students with the fundamentals of sustainability within the workplace in which they find employment and within communities where skills are valued as an integral part of local or community-based development. While greening the curriculum emphasizes the sustainability skills and contents that can be applied to a workplace setting, the 'greening of the workplace' focuses on what TVET education can contribute to influencing the greening of work environments, places of work or spaces where business activities are mostly carried out using processes, technologies and tasks. In practice, TVET institutions are in a strategic position to promote practices that contribute to reducing the environmental impact of business practices and, where possible, jointly develop sustainability programmes and projects in which skills and training could be instrumental to addressing local issues.

Institutions involved in developing capacities and providing professional training services to stakeholders in the community could play a key role in demonstrating this sustainability approach. A similar example from Costa Rica gives an insight into a project-based model of identifying local issues and developing solutions using specialized training developed for targeted groups.

BOX 13
INTEGRATING WASTE MANAGEMENT IN EDUCATIONAL AND PROFESSIONAL TRAINING FOR CAR MECHANICS IN COSTA RICA

In conformity with Costa Rica's goal to become carbon neutral by 2021, the Instituto Nacional de Aprendizaje (INA) created capacity-development opportunities to increase the level of environmental awareness, thus influencing the management of automotive waste. INA conducted an in-depth investigation to assist the local transportation sector in finding solutions to the serious problem of soil contamination observed during the repair of motor vehicles. This initiative was supported by collecting information on how automotive waste is managed throughout the country. These findings highlighted the environmental damage caused by incorrect waste disposal.

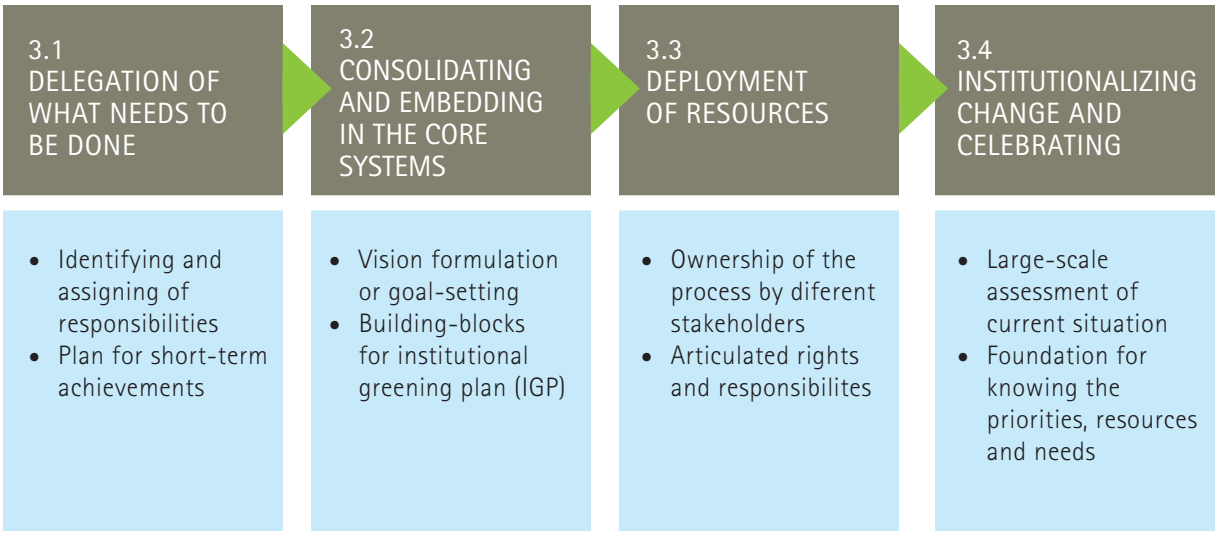
A good part of the strategy undertaken by INA was to design a series of projects. The first of these was piloted in automotive shops of education centres involved in teaching mechanic services. The aim was to support awareness-raising among those working in technical and civil field. Then INA developed modules that aimed at developing comprehensive waste management plans among teachers and students. These plans were implemented through short-term courses and a manual was developed to guide teachers and students during implementation of the integrated waste management plan. This was also complemented by the training of owners of automotive centres on the integrated management of waste. The project resulted in the successful implementation of waste management plans in five out of six educational training centres for car mechanics. The initiative was extended to train forty-five company owners using the course modules developed.

Source: UNESCO-UNEVOC (2014)

Within this sub-step, there is a need to reassure the staff, students and the community that this undertaking is a serious one. The institution should embed the new vision within its policy and publish a long-term plan of where it is heading. While this plan may entail detailed and complex specifications, initially clarity can be ensured by using a simple flowchart. It is highly recommended that this be based on the five approaches outlined in this *Guide*. Posters or pamphlets can be tailored for different departments, and yearly implementation plans should relate to the IGP. Each faculty, department or unit should see itself as contributing to the whole, and have targets and accountability indicators.

An advisory committee may consist of people from more than one faculty, department or unit. It is advisable to assemble a group of people with enough power to lead the change effort, and encourage them to work as a team. It is also advisable to assemble a group of experts from the local community who could link the initiative to other community-based greening initiatives. A third group may focus on obtaining resources or reviewing proposed projects. Yet another group might focus on specific issues, such as research.

STEP 3: Implementing the Institutional Greening Plan



Now that the greening process is understood and an overall plan of action has been determined, it is time for the third step: implementing the plan, developing the resources and support needed to successfully meet the targets, and organizing delivery. Step 3 focuses on developing a strategy for implementation.

Once the current realities have been established, priorities set and a plan created, the next stage is setting a strategy and commencing implementation. TVET institutions must implement the IGP through an open and collaborative process comparable to how the students themselves learn the lifelong skills of greening the workplace. This process will surely take into consideration twenty-first century employment skills, as there is no end in sight for greening. Just as continuous improvement and product enhancement are regular aspects of the world of work, the same process will apply to the greening of the workplace, the home and the student's personal lifestyle. This step deals with four components that should be considered in the implementation.

3.1 DELEGATION OF WHAT NEEDS TO BE DONE

A strong mandate is necessary to ensure that each faculty, department or unit is committed to pursuing a common direction. Based on the goals identified in previous discussions, there should be clarity about the actions to be undertaken and the steps to achieve the targets, such as the professional development needed or the curriculum reorientation. Departmental responsibilities should then be assigned to individuals or teams. TVET issues and responses should be tailored according to the different operating departments of the institution.

The initiative should begin with a series of actions designed to produce short-term achievements to create momentum. Plan for achievements that are readily apparent and are based on desired outcomes.

PLANNING FOR SHORT-TERM ACHIEVEMENTS

GREENING THE CAMPUS

Desired achievement and outcome	Getting there
Example Sustainability practices address enhancing green spaces through habitat restoration and aesthetics.	*Example* • Identify spaces or activities that contribute to the institution's carbon footprint; assess the activities that contribute to their deterioration/ unsustainable use; • Determine ways to transform spaces into 'green spaces' or activities into green practices; • Develop a sustainability plan in which the newly established purposes of these spaces and the measures to implement the plan are explained clearly to stakeholders; • Deploy materials and services that help maintain these spaces and keep them clean (e.g., garbage bins, garbage sorters, change in the garbage collection and disposal); • Develop a monitoring and assessment scheme to measure improvements.

GREENING THE CURRICULUM AND TRAINING

Desired achievement and outcome	Getting there
Example The cross-curricular focus of greening the curriculum is addressed through the study of topics across all subjects and levels, and through integrated courses of study.	*Example* • Offer general subjects that impart green knowledge, skills and competencies; • Identify occupation areas or skills sectors with higher demand for green skills; these demands must be determined through systematic collection and analysis of data; • Investigate which occupations are challenged by the lack of environmental aspects or occupation-specific skills to make them more environment-friendly; • If the institution exercises a degree of autonomy to develop courses and award qualifications, determine industry or enterprises to collaborate with in developing short-term courses or reviewing existing courses to enhance their green skills component; • If the institution is regulated, bring the matter up with authorities or bodies responsible for reviewing training standards or developing training curricula; • Develop a monitoring and assessment scheme to measure improvements.

Curricula are aligned with community needs regarding both content and delivery.	• Situation analysis of sustainability needs based on an existing practice and sustainability vision of the community; • Engage community-based groups in validating findings of analysis and collect input for designing interventions; • Identify partners and mobilize resources; • Identify specific TVET interventions for target groups and plan courses; • Conduct short-term courses; • Develop a monitoring and assessment scheme to measure improvements.

GREENING RESEARCH

Desired achievement and outcome	Getting there
Example Greening the research agenda becomes an integral component of the institutional culture.	*Example* • Encourage research-based activities across disciplines; • Identify research initiatives that improve classroom pedagogies or didactical methods, promote project-based learning and develop skills for sustainability (e.g., how to transform locally abundant materials into meaningful livelihood projects, investigating existing practices in waste disposal in small enterprises and co-developing solutions); • Involve teachers and students in these activities; • Create incentives; • Publish results and encourage more similar activities; • Develop a monitoring and assessment scheme to measure overall achievements.
The institution develops tools to collect data useful for systemic reforms.	• Identify a researchable area and focus (e.g., area in which sustainability issues as well as the green skills requirements can be investigated to guide curriculum and training development); • Develop a methodology for undertaking the research and the use of research findings; • Involve a core research team, and identify needs for external expertise; • Disseminate findings across relevant teams or throughout the institution to mobilize action; • Develop a monitoring and assessment scheme to measure overall achievements.

GREENING THE COMMUNITY AND WORKPLACE

Desired achievement and outcome	Getting there
Example Cooperative education supports greening partnerships with the community or with businesses who are potential employers.	*Example* • Identify potential partners with shared goals; • Establish targeted partnerships with local enterprises or business entities; • Identify partnership programmes with these new partners that promote sustainability concepts in the workplace; • Discuss a common agenda for greening the workplace; • Implement practical, experiential or volunteer training programmes as part of this common agenda; • Develop a monitoring and assessment scheme to measure impact or improvements in the workplace.

GREENING THE INSTITUTIONAL CULTURE

Desired achievement and outcome	Getting there
Example Assessment strategies measure progress in systemic implementation of IGP initiatives.	*Example* • Consolidate progress made through several small achievements across many spheres of implementing the plan; • Assess the impact of each activity or intervention and create mechanisms to reward achievements; • Disseminate information and draw feedback; • Determine new milestones taking into account the lessons learned from implementing and feedback.

The Appendix provides more information on possible achievements and outcomes that can be set for each of the approaches to be used.

BOX 14
GREENING STRATEGY IMPLEMENTATION AT FLEMING COLLEGE IN CANADA

Fleming College is renowned as a world-class learning institution located in Ontario, Canada. With about 6,000 full-time students, the college provides hands-on practical experience in all areas of sustainability. This spirit of sustainability is reflected in the college's sustainability learning outcome, which is currently part of required courses across 87 per cent of diploma programmes (with a goal that 100 per cent of all diploma programmes include the learning outcome). Sustainability engages the traditional environmentally oriented programmes, such as ecosystem management, ecological restoration, urban forestry and sustainable agriculture. On any given day you will find students working in the college greenhouse growing trees for reforestation, in the field learning about sustainable food systems, or in the Centre for Alternative Wastewater Treatment, which features an on-site constructed wetland for wastewater treatment.

However, ESD at the college does not stop there. Beyond greening the campus and its facilities, the college has moved on to greening its programmes. The college features a specialized Sustainable Building Design and Construction Programme where, each year, students design and build a sustainable building in the community. The college's Skilled Trades Programmes integrate sustainable practices into all of its areas of speciality and mainstream building design. In Fleming's School of Business, every student must take a corporate social responsibility course and learn how to apply sustainability principles through applied projects that tackle real-world sustainability issues. Fleming's new 'Culinary with a Conscience' programme focuses on local and sustainably sourced food and eating for wellness, where students learn the full life cycle of food as part of their practice. Fleming's Early Childhood Education programme focuses on children's health and the environment and the importance of nature education, outdoor play and using natural materials. Students must explain the interconnections between human and ecological health and well-being, social issues and secure livelihoods. Faculty utilize UNESCO's ESD resources to help students meet the requirements. This means that the vast majority of students will leave the college not only with an understanding of sustainability, but with the hands-on experience of applying sustainability principles to their field of practice.

Fleming is an important element in the overall community's regional sustainability plans. The college has a seat on a number of municipal planning committees and health boards, while the faculty and students work closely with the NGO community to build a more sustainable region. Both the public and private sectors advise the college on the sustainability skills its graduates need, and the faculty and administration work in synergy to adapt the curriculum to meet emerging regional needs. Sustainability is a core value in Fleming College and a crucial part of its mission.

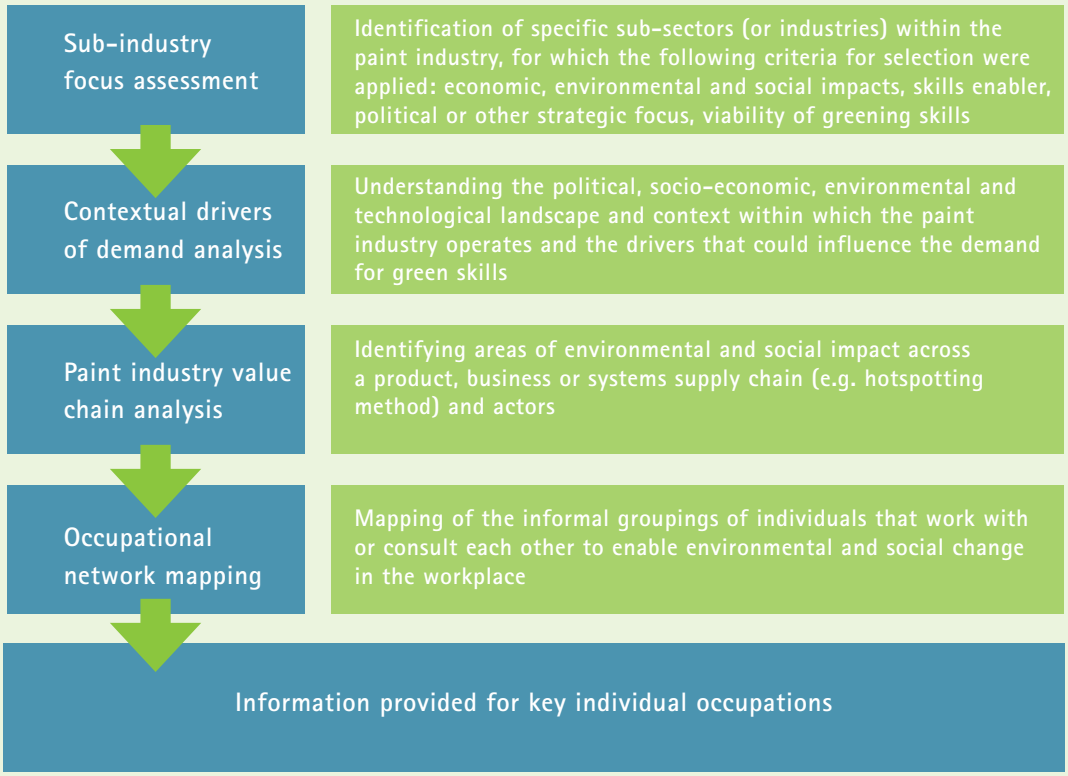
Source: Fleming College (2016)

Not every institution has complete independence or resources to carry out concrete steps to generate information about the spectrum of changes in the skills need in a particular sector. Often, their resources are limited to carrying out actual implementation of activities within their mandate. These limitations may exist but should not deter actions. Scarcities may also be present but so are the untapped opportunities. Establish linkages and partnerships with other governmental initiatives that possess the mandates to support education and training providers. This can save institutions from undertaking processes and deploying resources that often lead to frustration when there is a lack of resources or expertise available within an institution. Institutional implementation of strategies can then be based on established information and guided priorities within a skills sector or territory.

Institutions can explore how to be part of a bigger process or make use of resulting data and analytical information to guide the institution's green plan implementation processes. An example of this is planning institutional strategies around the issue of skills gaps and training needs.

BOX 15
METHODOLOGY FOR MAPPING GREEN SKILLS DEMAND IN THE PAINT INDUSTRY IN SOUTH AFRICA

South Africa's Chemical Industries Sector Education and Training Authority (CHIETA) strengthens South Africa's green skills planning systems in this sector guided by a methodology that helps determine green skills priorities and demand at the firm and sector level in the paint industry. The study provides a comprehensive set of green skill occupational profiles related to the paint industry, drawn from a rigorous process of assessment, analysis and mapping exercises.



Source: Jenkin et al. (2016)

3.2 CONSOLIDATING AND EMBEDDING IN THE CORE SYSTEMS

Once the programme is launched, consolidate and build on the gains. Use the increasing credibility to change more systems, structures and policies that employees identify as not corresponding to the overall vision. Embed the IGP in core systems, such as human resources. Hire, promote and develop employees who can implement the vision. Rejuvenate and maintain the momentum with new projects, themes and change agents.

3.3 DEPLOYMENT OF RESOURCES

The deployment of resources is a crucial step that is watched by all. The savings made on energy, water and waste management are a focal point of attention for most projects. Significant gains can result from many small acts spread over the entire campus, and it may be possible to reinvest these gains in the process. Often large-scale physical investments, such as boilers and insulation, go unseen by most, yet they can lead to huge reductions in operating costs. A campus-wide communication plan needs to explain why it was decided to carry out the measure, putting it in the context of the IGP, and giving recognition and thanks to all concerned.

The deployment of human resources is also a crucial part of the strategy. It takes care and thought to choose the right faculty members who will carry the messages to others, lead the training of other faculty members and coordinate the plan.

3.4 INSTITUTIONALIZING CHANGE AND CELEBRATING

Recognize the connections between the new behaviours and organizational success, and achieve the means to ensure continuous leadership development and succession. In many cases, there will be new learning and professional growth. There should be a way of acknowledging this learning and harnessing it to revise and improve the process in an ongoing manner.

The whole-institution approach calls for a permanent and ongoing process, with continuous modification of the institutional plans. This capturing of learning and staff engagement in the modification process is essential to maintain momentum. Celebration and rewards are also an important part of maintaining the programme. There is a very high possibility of making financial savings as a result of the IGP. This is usually the case with energy, water and waste reduction initiatives. It is helpful to set a transparent policy for how the additional funds released are to be used. This could become a part of the communication strategy of monitoring and assessment.

IMPLEMENTING IDEAS

1 GREENING THE CAMPUS

Greening a polytechnic in Australia

Melbourne Polytechnic's Epping Campus is home to the ground-breaking Green Skills Centre of Excellence. During 2010–11, the polytechnic (the former Northern Melbourne Institute of TAFE) built this state of the art facility to support the training and delivery of knowledge and skills development in environmentally sustainable practices. The building embodies environmental sustainability in its construction and design, and not only contributes effectively to efficient energy and resource management, but has also been used as an ideal training model for educational programmes. The use of low-carbon sustainable technologies can provide skills development and practical learning opportunities across a wide range of industry sectors, including manufacturing, construction, training, retail, installation, repair and maintenance. This Green Skills Centre achieved a five-star rating from the Green Building Council of Australia's 'GreenStar' assessment, which represents a level of 'Australian Excellence' in the design of an education facility.

Sources: North Melbourne Institute of TAFE (n.d.), SkillsOne (2016)

2 GREENING THE CURRICULUM AND TRAINING

Integrating green skills in training in the Philippines

TESDA (the Technical Education and Skills Development Agency), the main agency mandated to train and certify the qualifications of skilled workers in the Philippines, has included green skills in many certified training courses it offers, including in agriculture (vermiculture, vermicasting and organic agriculture production), construction (photovoltaic systems installation, design and servicing), waste management (site foreman,

spotter and garbage collection), refrigeration and air-conditioning, and automotive (including CFC phase-out, recovery, recycling and conversion, retrofitting and repowering). Similarly, green skills have been embedded in some training regulations. The initiative was also stimulated by the greening of practices in Philippine companies, and is now redefining the different occupations for which the skilled workforce receive formal qualifications.
Source: UNESCO-UNEVOC (2015b)

Greening teacher education in Nigeria

The Department of Vocational Teacher Education of the Centre for Technical and Vocational Education, Training and Research (CETVETAR) has reviewed and revised its teacher education curricula. It now includes two mandatory face-to-face courses in its postgraduate programme: Green Technology and Skills Development, and Emerging Issues and Innovations in Technology Education, which are infused with green economy issues. These form part of the academic programme interventions. Outreach activities of CETVETAR for TVET teachers include a series of greening TVET workshops aimed at advocating and sharing experiences on best approaches to infuse emerging greening concepts and ideas into the curriculum of TVET institutions and departments. Another intervention is on enhancing the capacity of TVET teachers in responding to emerging training needs for green skills, which will be based on a research-based exercise on the skills needs of teachers.
Source: CETVETAR (2015)

Greening the woodcraft technology curriculum in Fiji

A vocational school in a rural area of Fiji partnered with a local timber mill to improve the relevance of and inject sustainable development principles into its Woodcraft Technology programme. The programme teaches students how to add value to 'waste' wood from the sawmill. Students construct lamp stands, ornaments, statues and the like from waste timber, which are then sold. In addition to teaching practical and applied skills in a learner-centred manner, the programme also includes an entrepreneurial component which raises funds for the school, improving its sustainability.
Source: UNESCO (2016c)

Sustainable building design and construction curriculum in Canada

Fleming College in Canada offers intensive, hands-on experience where students from across Canada learn to construct a new sustainable building, showcasing green building technologies and new energy-saving techniques. Students interact with project consultants, inspectors, and tradespeople and are involved in all aspects of constructing a sustainable building. Such programme had been described as an excellent combination of theory and practical skills where students are educated in class and then given the opportunity to experience their acquired knowledge on site. Students learn first-hand sustainable construction practices, are introduced to renewable energies, and are given the freedom to not only think for themselves, but act as a leader experiencing the entire process.
Source: Fleming College (2016)

Greening training in Germany

The revision of training regulations in Germany has allowed the incorporation of environmental subjects into existing initial training. The complex tasks and skills needs in the waste management trade demanded revised training that would lead to specialized qualifications. The original training course called Provider and Disposer was revised and extended to produce courses designed to train individuals for four new environmental-technical trades: Recycling and Waste Management Technician; Water Supply Engineering Technician; Sewage Engineering Technician; and Pipe, Sewer and Industrial Service Technician.
Source: Stock and Vogler-Ludwig (2010)

Greening training for the chemical industry in Germany

Under a project entitled Sustainable Educational Careers in the Chemical Industry (NaBiKa), the Rhein Erft Academy initiated an 'Around the Clock – 24-Hours Real Time' activity which helped fifty trainees from different vocational fields work on interdisciplinary projects in three shifts during the week. Chemical technician trainees and industrial mechanics, for example, were first trained on the topic of sustainability and engaged in team work. This mainly involved organizing their work across their individual trades and interacting and communicating with each other, training them to exercise collective responsibility across the areas of the chemical industry, safety and health. The trainees learn specialist skills and have opportunities to develop their personal capabilities, through a standard sustainability protocol that has been drawn up for their guidance, and through the different tasks performed involving team communication, coordination and work shifts. The trained technicians were certified as experts on sustainability and later returned to their companies with the aim of stimulating sustainability in the workplace.
Source: Germany (2016)

Greening of training in Europe through the GT-VET project

Developing a sustainable training module is the focus of a European project involving the steel industry in four countries: Germany, Italy, Poland and the United Kingdom. The project seeks to develop a European green training module that will meet environmental, health and safety skills needs in TVET pathways in the steel industry, with potential to transfer to other professions and industry sectors. It further aims to serve as a blueprint for countries that are interested in obtaining identical learning outcomes in the field of green skills and sustainable awareness, complementing current TVET programmes. The module will be tested in four steel companies (ThyssenKruppSteel Europe, ArcelorMittal Poland, Tata Steel UK, and ThyssenKrupp Acciai Speciali Terni) and TVET institutions in the four country partners.
Source: UNESCO-UNEVOC (2013)

Greening training and certification for the skilled workforce in Austria

The Austrian Institute of Technology has developed specific training courses and certification schemes for installers and planners of heat pumps (since 2005) and for installers and planners of solar thermal and photovoltaic installations (implemented in 2010). The training to become a Certified Solar Heating Installer and Planner, and the compact course 'Solar Heating Practitioner' provide trainees with the theoretical as well as practical expertise needed for proper planning, assembly and installation of high-quality solar thermal systems. These courses target plumbers and fitters, planning engineers, roofers, architects, engineering firms, heating, ventilating and air-conditioning (HVAC) companies and retailers.
Source: OECD and CEDEFOP (2014)

3 GREENING RESEARCH

College research project in Nigeria

The Water Hyacinth project was initiated in 2012 by the Yaba College of Technology as a waste-to-wealth initiative that combines action research and skills training for students to address issues related to the clogging of waterways in Nigeria by the superabundance of these plants. Students at YTC turn the invasive hyacinth plant into an income-generating resource by studying it and transforming it into other forms. The programme trains students on how to make different eco-friendly handicrafts, biogas and animal feed from the plant. Students are taught how to harvest the plant, dry it and weave into products that they can sell. Research projects are also carried out on the bioremediation ability of the plant, construction of a drying machine and so on.
Source: Yaba College (n.d.)

Applied research in New Brunswick Community College, Canada

The college sets as a vision for research the building of a supportive culture for applied research that contributes to the learning experience. This indirectly benefits students and its faculty in developing new courses, programmes and faculty expertise, and in the development of areas of expertise that also benefit the college on a long-term basis by connecting the college with applied research opportunities and the further development of a college or regional specialization. By encouraging applied research to solve local needs, the college also identifies opportunities to serve the socio-economic needs of communities through applied research.
Source: CICan (2016)

4 GREENING THE COMMUNITY AND THE WORKPLACE

Greening construction through green masonry training in the Philippines

Green Masonry Skills training is an initial implementation of the Green Masonry curriculum in the Masonry-National Certificate II Training. It targets construction workers in the informal sector, and builds upon an established certificate training programme. The programme integrates green masonry concepts into the existing NC II Masonry Training. The training builds up competencies that enable trainees to perform basic tasks (NC I) and, in addition, to lay bricks/blocks for structures, plaster concrete masonry/concrete surfaces, and install precast balusters and handrails. Integrating green masonry concepts aims to have learners appreciate climate change as a personal, social and construction issue, to understand the possible effects as well as the direct and indirect impact of climate change, to identify green building concepts, and to recognize the importance of different practices towards green masonry. At the same time, it should lead to an understanding of the need for proper identification of building materials to protect and conserve the environment, and help

students differentiate between renewable and non-renewable resources, resource efficiency and waste management, and adopt practices that foster greening of the workplace. The training programme includes concepts about green masonry, actual Masonry NC II training, actual application, labour standards and occupational safety, and health and waste management. The training is a partnership programme between TESDA, the Department of Labour, the Green Building Council and construction industry companies and associations.

Source: ILO (2012)

CICan clean tech internship programme

Colleges and Institutes Canada (CICan), in partnership with Environmental and Climate Change Canada, encourages post-secondary graduates in STEM (science, technology, engineering and mathematics) studies through internship placement. Partnerships are established with employers, who also receive incentives in the form of workplace subsidy. Through workplace subsidies, the programme provides interns with opportunities to work for eligible employers that are improving environmental and economic outcomes in Canada.

Source: CICan (2016)

Greening training (apprenticeships) in the United Kingdom

In the United Kingdom, young people who are not in education, employment or training are encouraged to join training schemes, such as initial training (pre-apprenticeship) opportunities in horticulture (Level 1 NVQ) and progress to a long-term apprenticeship programme (up to Level 3 NVQ) once they have been successful. The initiative is organized by local government with partners to train a new generation with skills to grow plants and maintain green spaces. Glendale Liverpool maintains 10 million m^2 of green space including recreational open spaces and sixty parks, and employs apprentices who are given experience and work-specific skills. The initiative is one of the pioneering examples of cooperation between local government, Glendale Liverpool and Myerscough College.

Source: Glendale Services (n.d.)

5 GREENING THE INSTITUTIONAL CULTURE

The greening of institutional culture is embodied in various initiatives in Canada supported by the coordinating work of CICan, as well as by that of the US-based Association for the Advancement of Sustainability in Higher Education. Different levels of activities have been implemented in Canadian colleges using one or more approaches to sustainability. These include infusing skills for sustainability across the curricula, and teaching and learning using place-based learning, service learning and action research. Green skills development was also at the core of the activities of Canadian institutions through the modification of programmes and their learning outcomes to become greener, the creation of partnerships with industries, including co-development of academic standards, and strategic shifts to programme design, teaching and learning assessments. Research-oriented actions were implemented, including the development of research-driven curricula and increased engagement of students in applied research. A non-academic movement took the form of greening the campus through embedding sustainability in the college's vision, mission, and strategic and operational plans and policies. Student and community engagements, modelling of sustainable practices to transform institutions into 'living laboratories' of sustainable learning, and greening of campus operations (including buildings, transportation, landscaping, food services, student residences and resource conservation) were also vital aspects of greening. The interrelated initiatives were not necessarily coordinated or college-wide movements, but served as important building blocks to shape a sustainability continuum.

Sources: CICan (2016), Knibb and Paci (2016)

PROJECT IDEAS WORTH EXPLORING IN THE CLASSROOM

Food industry:

- Brewing beer out of food waste
  https://www.ellenmacarthurfoundation.org/case-studies/brewing-beer-from-surplus-bread
- Recycling used cooking oil for the biofuel industry
  https://www.ellenmacarthurfoundation.org/case-studies/unlocking-value-from-used-cooking-oils
- Introducing new and recyclable alternatives to plastic materials
  http://www.threec.eu/wp-content/uploads/2016/10/Porto_presentation-Cork-project-1.pdf

Infrastructure and construction:

- Tyre recycling to reduce traffic noise
  http://ec.europa.eu/environment/eco-innovation/projects/en/projects/ruconbar

Farming industry:

- Recycling fish farming equipment to reduce plastic waste
  http://ec.europa.eu/environment/eco-innovation/projects/en/projects/eufi
- Sustainable aquaculture
  http://www.zerowastescotland.org.uk/sites/default/files/2870%20ZWS%20Bio%20Economy%20Loch%20Fyne%20Case%20Study%20AW%20FINAL%20HI%20RES.pdf

Fashion industry

- Teaching sustainable fashion
  http://www.threec.eu/wp-content/uploads/2016/10/PortoCircularfashion.pdf

STEP 4: Monitoring Progress and Assessing Results

4.1 ESTABLISHING THE REASON FOR MONITORING

4.2 CLARIFY THE SCOPE NEEDING ASSESSMENT

4.3 DEVELOPING A MONITORING AND ASSESSMENT FRAMEWORK

An important component in the greening of any institution is guiding the continuous progress of the change through monitoring and assessment (M&A). Assessing actual progress in each of the five approaches to sustainability for TVET institutions helps in monitoring the level of progress based on a set of expectations and predetermined indicators of achievements. These expectations are set up in the IGP, described in the implementing guidelines and monitored using clear criteria and assessment indicators.

Progress in the greening of TVET can be assessed both qualitatively and quantitatively. Easier to measure aspects such as the number of courses and students lend themselves to quantitative measurement, but other important aspects are not so easy to measure, and must be assessed qualitatively. It is essential to set targets, but not that they should be objectively measurable. An initial overview of the monitoring progress could make use of Gantt charts, showing timeframes of expected results or planning. A more detailed version could be made for different divisions or departments. Furthermore, observations of benefits (quantitative and qualitative) should be tracked alongside costs and savings.

Tools for assessing and monitoring progress could provide useful support. They can be customized to suit the level of progress desired to be monitored and the outcomes planned to be achieved.

The different approaches to sustainability as discussed in this *Guide* can be measured and evaluated based on different sets of outcomes. An outcome can be a specific change or attribute that an institution aspires for and what an institution works to achieve on a step-by-step basis. A four-stage model is offered by this *Guide* to suggest different levels for assessing the outcomes.

4.1 ESTABLISHING THE REASON FOR MONITORING

Using a learning/assessment tool

A thoughtful approach to M&A is needed in order to engage the faculty and facilities/operations staff in a constructive manner. There should be clear, reasonable targets and objectives, together with a rationale justifying their choice. This form of explanatory framework can turn a judgement tool into a wonderful learning tool that informs and engages. Some examples of this format can be found in the Appendix.

Some targets can be met through technological investment, while others will only be achieved with the overall commitment of all those involved with the institution, including the student body. The first category may involve a large-scale capital investment, while the second requires a change in human behaviour. It is wise to develop a transparent, rational framework complete with targets, responsibilities and feedback mechanisms to build corrective or enhancement measures. There is a need to be ready to add new projects and contributions arising from those on the campus or in the community. These might, for instance, involve curricular reform, food services changes, transportation measures or social/equity initiatives.

Monitoring as progression, dynamic

The M&A process should be dynamic and open to new measures as goals and targets are met. The addition of new buildings or enrolments may change the targets as much as the introduction of new technological measures. In the same way, projects and initiatives that vary from season to season also affect M&A outcomes.

M&A as a self-directed tool

So much of the greening process is the result of individual change in what is taught or in the choice of personal lifestyle. This involves a strategy to engage individuals in setting personal as well as departmental or group goals. It can be useful to introduce learning circles and other methods of engaging the faculty and support staff in order to feed ideas back into the dynamic plan. Making M&A a discussion point in the performance and assessment of support staff is also recommended.

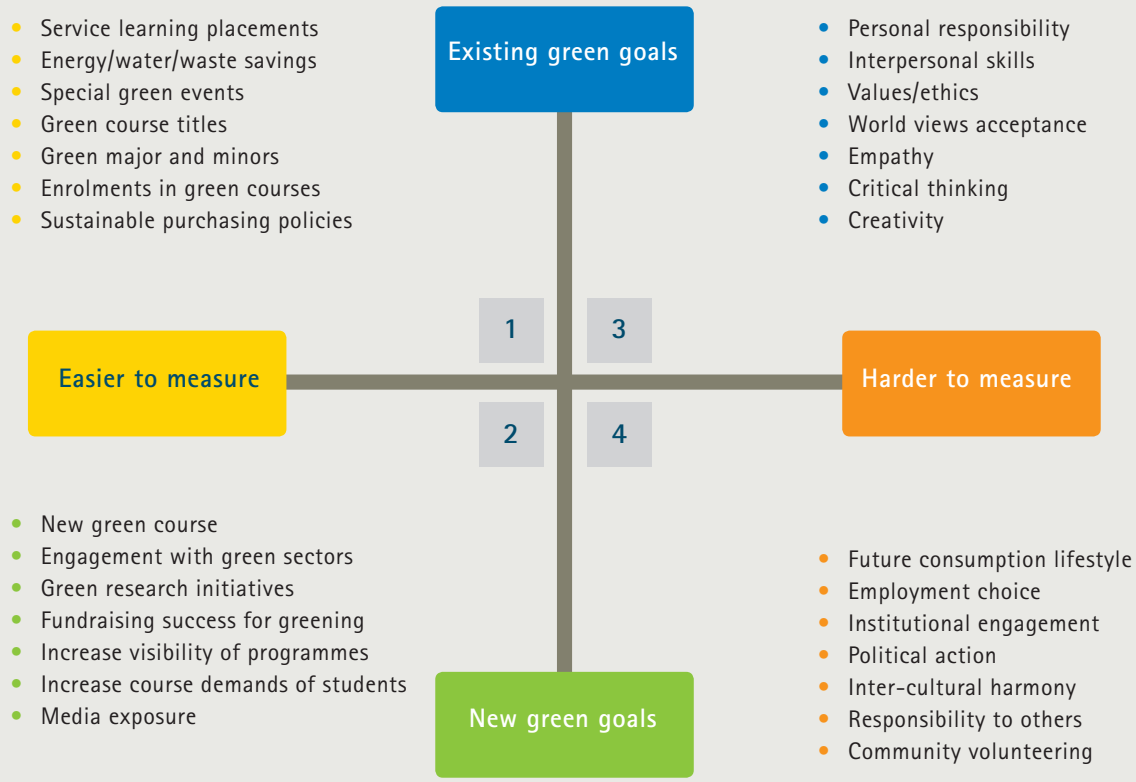
4.2 CLARIFYING THE SCOPE NEEDING ASSESSMENT

As well as quantitative changes, qualitative ones need assessment; as well as dramatic changes, it is important to be aware of gradual and incremental ones. Subtle changes that call for care in assessment include institutional reputation, increases in the quality of offers for student placement, the hiring of graduates, and the overall satisfaction of both staff and students.

The first step relates to clarifying what aspects in the greening process are easily measured and what are not, within a specific timeframe.

It is important to consider the scope of M&A. The greening that leads to savings is indeed crucial, as this is an important source of funding for the whole process. Even small measures can make a significant difference. For example, exhaust fans that operate at night during the winter, pumping heated air into the environment, can waste thousands of dollars over a year: it is a small but very useful step to ensure they are switched off. While serving the student is the prime goal of the institution, not all that is important to the student can be easily measured. It is important to monitor the curriculum – the mind is every bit as important as greening the campus. This aspect of greening is often very difficult to assess, as the outcomes may only become apparent long after the student graduates and enters employment (Fig. 9).

FIG. 9
APPROACHES TO ASSESSMENT



The variables are divided along two axes. The horizontal axis runs from 'easier to measure' to 'harder to measure', while the vertical axis ranges from existing greening goals to new greening goals. Quadrant 1 shows existing goals that are currently measured while quadrant 2 shows future measurable goals. Quadrant 3 indicates those related goals that are often spoken of but very seldom measured and reported upon. Quadrant 4 shows future hoped-for goals concerning the institution and its graduates that are largely not measurable at the present time. Yet these goals in quadrants 3 and 4 are extremely important. They should be addressed in the programme and acknowledged in any assessment report.

Source: authors

4.3 DEVELOPING A MONITORING AND ASSESSMENT FRAMEWORK

Some generic tools for assessing and monitoring progress could provide useful support in customizing the design of a simple-to-complex monitoring scheme.

Scoring rubric

A simple example is a tool to map the desired outcomes according to the different approaches to sustainability that have been prioritized in the IGP. A scoring rubric identifies incremental achievements in the change outcomes desired and the impact of the progress made. This assessment allows for learning, measuring and facilitating institutions to take actions at the right time, in coherence with the self-directing mechanism that measures and evaluates the achievements of individual and institutional goals.

For qualitative assessment, institutions can map their progress against each of the proposed approaches to sustainability by assigning it to a defined stage.

For example, a four-stage model might be based on:

- 'beginning' stage: early adaptation;
- 'some progress': some evidence of adaptation;
- 'satisfactory progress': evidence of adaptation is producing observable results;
- 'stable and embedded change': evidence and results demonstrate the impact that the greening action makes; creates stable and demonstrable changes.

Figures 10 and 11 provide sample templates that can be used and developed for monitoring and assessing greening TVET progress and outcomes.

Spider charts can also be used to visualize progress across different areas in greening (variables). Values may be assigned for each axis, beginning at the centre. This can provide a starting point to map the progress in each variable. Figure 11 provides an example of plotting progress in each of the approach to sustainability discussed in this *Guide*.

FIG. 10
A TEMPLATE FOR A FOUR-STAGE ASSESSMENT

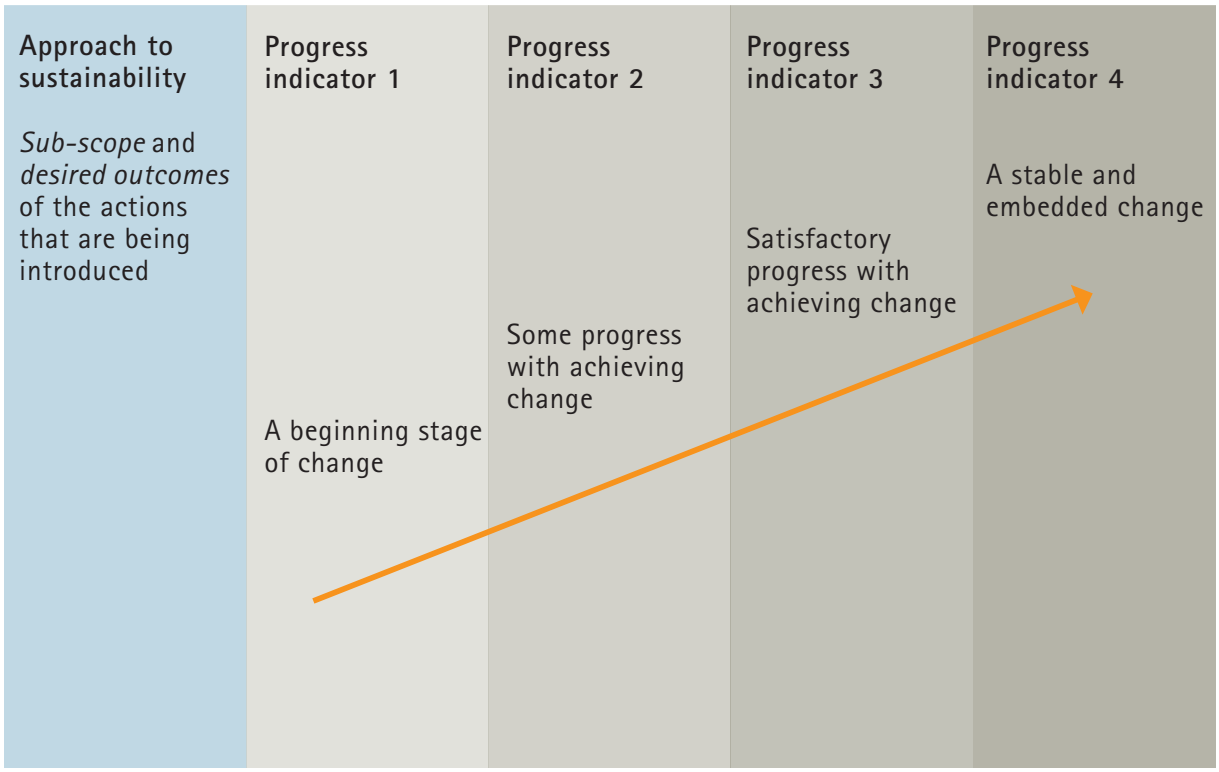
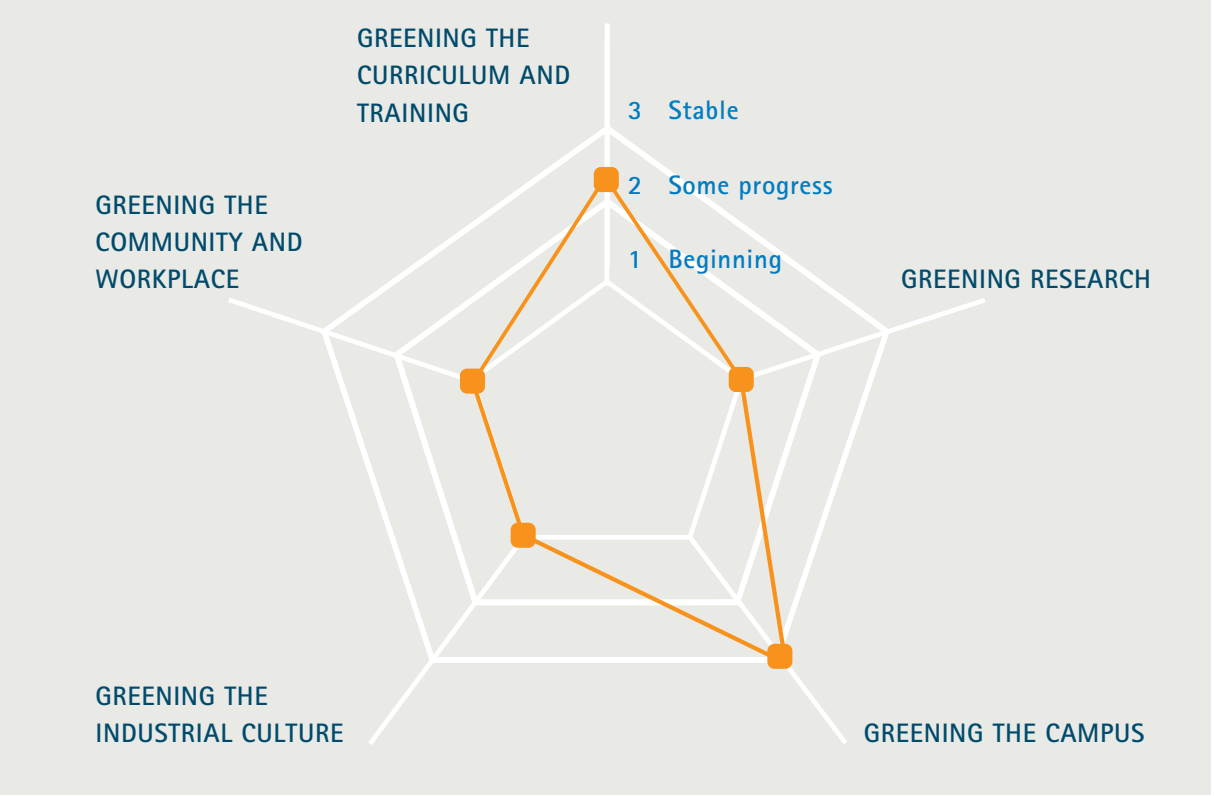


FIG. 11
AN EXAMPLE OF A SPIDER CHART



Developing an M&A plan

The next step adapts an M&A framework plan for assessing the greening of TVET initiatives by introducing the approaches to sustainability for TVET institutions that we have described. The overall purpose of this step is to assess an institution's degree of progress in acting on its IGP and achieving measurable and observable results.

The process starts with mapping the desired outcomes under each of the approaches or areas, and identifying different levels or degrees of achievement that illustrate significant progress. Ideally, this should already have been established in the course of formulating an IGP. The desired outcomes can be assessed either qualitatively or quantitatively.

Fostering change in all the aspects of an institution's work in any or all of the dimensions of the greening of TVET could signal positive transformations and improvements of systems and ways of working. The framework is also a learning tool, as it outlines the desired future. An example of an extensive M&A tool is presented in the Appendix for reference purposes. This tool can be modified according to context and the institution's specific vision.

Benchmarking

The Sustainability Tracking, Assessment and Rating System (STARS) has been designed by the Association for the Advancement of Sustainability in Higher Education (AASHE) for use in universities and colleges. Some of the colleges used as examples in this *Guide* self-track their progress using STARS's monitoring tools. George Brown College, for example, uses STARS, which enables the college to identify areas where it can be considered a leader in sustainability performance. This framework also makes it possible to assess and rate areas for improvement. This is important in order to make further progress in the college's sustainability goals. Designing a similar assessment tool specifically for TVET institutions, rather than for higher and further education more generally, is an area for further development.

TABLE 3
An example of a scoring framework to assess progress in greening the campus

Approach to sustainability	Parameters for evaluating the outcome	Scoring framework			
		Beginning	Some progress	Satisfactory progress	Stable and embedded change
Greening the Campus: Facilities	Sustainability principles are applied to the design, construction and renewal of buildings, including innovative financial models.	A little focus on sustainable practices.	Sustainable practices are often incorporated in the site. However, there are no specific criteria to guide development of renewal or new building sites.	All departments are asked to incorporate and report on sustainable practices in their sites. Each renewal or new building site is asked to address sustainability principles.	All departments report on sustainable practices. They are supported with documents and professional development.

BOX 16
STARS OVERVIEW

The Sustainability Tracking, Assessment and Rating System™ (STARS®) is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance. STARS is intended to engage and recognize the full spectrum of colleges and universities – from community colleges to research universities, and from institutions just starting their sustainability programmes to long-time campus sustainability leaders. STARS encompasses long-term sustainability goals for already high-achieving institutions as well as entry points of recognition for institutions that are taking their first steps toward sustainability.

STARS is designed to:

- provide a framework for understanding sustainability in all sectors of higher education;
- enable meaningful comparisons over time and across institutions using a common set of measurements developed with broad participation from the international campus sustainability community;
- create incentives for continual improvement toward sustainability;
- facilitate information-sharing about higher education sustainability practices and performance;
- build a stronger, more diverse campus sustainability community.

Source: Aashe (2016)

APPENDIX:
A Greening TVET Monitoring and Assessment Framework

1 GREENING THE CAMPUS	DEGREE OF IMPLEMENTATION			
Desired Outcomes	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
1.1 FACILITIES				
Sustainability principles are applied to the design, construction and renewal of institution buildings, including innovative financial models.	There is a little focus on sustainable practices. Sites for renewed or new buildings have sustainable principles discussed as an option.	Sustainable practices are often incorporated in the site. However, there are no specific criteria to guide the development of sites for renewed or new buildings.	All departments are asked to incorporate and report on sustainable practices in their sites. Each renewal or new building site is asked to address sustainability principles.	All departments report on sustainable practices. They are supported with documents and PD. Staff and students are involved in promoting sustainable practices. Promising practices are celebrated. All renewal or new buildings include sustainability principles.
1.2 LEARNING IN AND FROM GREENING THE SITE				
Institution structures and outdoor spaces are seen as 'facilities' that teach sustainability practices.	Teaching sustainability practices only occurs in classrooms.	Sustainability practices occur in other teaching and training facilities (laboratories/workshops). Teachers/trainers motivate students to develop their own sustainable practices.	Sustainability practices occur in other teaching and training facilities. Students create sustainable practice plans and routines (e.g. disposing of workshop wastes).	There is a system policy and financing scheme to support appropriate practices developed by students to apply sustainability concepts and practices and engage the community.

1. CAMPUS	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
1.3 GREENING THE PHYSICAL SITE				
Sustainability practices address enhancing green spaces through habitat restoration and aesthetics.	Existing green spaces are conserved and protected from other uses. Garbage bins are deployed to keep the institution clean.	Green spaces are expanded and carefully maintained for aesthetic and leisure purposes. Garbage is categorized.	Green spaces are created and maintained to combine the purposes of education, research, leisure and aesthetics. Waste recycling and reuse are encouraged.	The IGP has habitat protection and enhancement in policy, which is enforced.
1.4 OPERATIONS				
Sustainability principles apply to all aspects of institution management, procurement and resource use.	Specific criteria or requirements for incorporating sustainability in procurement or institution management are rare.	Institutions and departments are encouraged to incorporate sustainability principles in procurement, institution management and resource use.	Individual departments have requirements for sustainability principles in procurement, institution management and resource use.	Policy and criteria for procurement, institution management and resource use are enforced. Sustainability practices, PD and fiscal support are provided to assist.
1.5 TRANSPORT SERVICES				
Sustainability principles are incorporated in transportation decisions.	Protocols are seen as an asset to be put in place to address sustainability.	Efficiencies are incorporated in transportation routes.	Protocols are in place to address efficiencies with respect to transportation routes and fuel-saving vehicles.	Protocols, measuring and monitoring are in place to address efficiencies with respect to routes and fuel-efficient vehicles.
1.6 AUDIT/TRACKING				
Audit tools are used to assess impacts and improve efficiencies as a result of sustainable practices.	Formal audits are in the planning stage.	Some areas of facilities have audit tools and assess the efficiencies of their practices.	Audit tools are in place to assess sustainable practices in all aspects of facilities.	Every institution conducts an annual audit and reports results to a central department.
1.7 WHOLE-COST ACCOUNTING				
Audit tools address commonly measured workplace issues, such as water, waste and energy management, but also address the underlying reasons beyond cost such as carbon and ecological footprints.	Plans and strategies are made to audit and track whole-cost accounting.	Events or awareness campaigns on energy, water and waste management are held periodically and these become test audits. Carbon offsetting mechanisms are used to reduce the carbon footprint in a cost-effective way	Records are kept and management of these issues is incorporated into some whole-cost accounting. Using carbon offsetting mechanisms is only used as a last resort after looking at energy saving and use of renewable energy.	The overall rationale for reducing carbon and ecological footprints is understood. Audits and savings are reported and celebrated. Student skills in auditing are documented and certificated.

2 GREENING THE CURRICULUM AND TRAINING	DEGREE OF IMPLEMENTATION			
Desired Outcomes	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
2.1 THE IMPORTANCE OF GREENING				
The cross-curricular focus of greening is addressed through the study of topics across all subjects and levels, and through integrated courses of study.	Greening is only seen as a topic for specialized courses to train for environmental qualifications.	Green knowledge, skills and competencies are taught in general and specialized courses.	Green knowledge, skills and competencies are taught in general and specialized courses and are required in implementing TVET programmes.	Greening is identified as a priority in all resource documents and across all grades/ levels. A clear scope and sequence within and across qualifications or competency levels is identified.
2.2 GREENING IN ALL ASPECTS OF CURRICULA				
Curricula and training for institution-based teaching or as part of work-based learning adequately reflect a greening focus or topics in subjects.	Green training programmes and qualifications serve the students' needs and interests.	Curricula reflect a greening focus in some subjects.	Curricula reflect a greening focus in all subjects and qualification competency levels. Graduates from the institution that teaches green skills and relevant practical experience are on high demand.	Greening in its broadest form is an essential part of all curricula. Graduates of these courses that are oriented to green competencies are very employable.
2.3 VALUING AND RECOGNITION OF GREENING				
Greening the curriculum is motivated by internal and external factors that are highly valued by the entire institution.	Greening the curriculum is a compliance mechanism to access funds, and meet training and occupational skills standards.	Greening skills and competencies are systematically added to existing and new qualifications/ programmes.	Greening skills and competencies are systematically added and constantly updated to existing and new qualifications/ programmes, and become a specialty of many existing departments and programmes to meet new occupational needs.	Green curriculum approaches have earned acknowledgement for the institution in supporting local industry, livelihoods and local wealth generation. Greening the curriculum is a specialized function and service of the institution to help other local institutions in adjusting their curriculum approaches.

2. CURRICULUM AND TRAINING	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
2.4 LINKING CURRICULA TO COMMUNITY/BUSINESS SUSTAINABILITY NEEDS				
The institution has an important role to play in developing a green work culture and society within the local community.	Green training programmes and qualifications serve the students' needs and interests.	Greening the curriculum is motivated by green economic transitions (e.g. green jobs in solar, renewable energy industries), new training regulations and the desire to ensure employment of graduates in critical industries/occupations.	Green skills are taught and trained based on evidence of skills shortages and mismatch in the local labour market and community, and knowledge of potential alteration/ elimination of jobs. Work-based learning/ training is offered in green skills or upskilling.	The institution is publicly recognized for its specialized role, such as becoming a centre of excellence in a sustainable development area within the institutional mandate. There is continuous evaluation and improvement of the match between the offered institution courses or work-based training programmes and the demand for green skills/competences.
2.5 GREENING IS INCLUSIVE				
The curriculum encourages local entrepreneurship and the engagement of disadvantaged groups (e.g. young people, women, persons with disabilities, rural communities and other vulnerable groups).	Greening the curriculum is a compliance mechanism to access funds, and meet training and occupational skills standards.	Greening of the curriculum is motivated to inform processes to promote activities, products and services that affect the community including disadvantaged groups; enhance wealth generation and local industry patronage.	Greening the curriculum cultivates self-enterprising individuals who can expand local industry and resource production and create jobs. Greening the curriculum mainstreams disadvantaged groups in institution-based projects that promote community engagements and activities of some sort.	Programmes offered serve local as well as regional and international students' skills and competency needs on greening. Curricula are tailored for students/adults with economic, cultural, or physical barriers to facilitate their entry or return to labour market. Institutions benefit disadvantaged groups through short-term courses or other formal and non-formal trainings.
2.6 INNOVATIVE DESIGN OF COURSE DELIVERY				
Curricula are aligned with community needs regarding both content and delivery.	A survey of community sustainability needs is conducted.	Possible new courses are planned for specific groups; courses are expanded from one-day to multi-year duration.	New and continuing training programmes and courses are specifically opened to serve the interest of students and company employees.	New and continuing training programmes and courses are specifically opened to serve the interest of students and company employees, and this specialized function of the institution is well recognized.

2. CURRICULUM AND TRAINING	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
2.7 CURRICULA RECOGNIZE TRADITIONAL SUSTAINABILITY PRACTICES				
All curriculum documents are inclusive of different disciplines, cultures and perspectives, including indigenous/ traditional knowledge and worldviews.	Some resources begin to address different disciplines, cultures, perspectives and worldviews.	Resources include local indigenous/traditional knowledge and are inclusive of some other cultural perspectives.	A protocol identifying criteria for assessing inclusiveness of resources for different disciplines, cultures, perspectives and worldviews, including indigenous/traditional knowledge components is in place and used to assess resources.	All resources meet the requirements for inclusivity and indigenous/traditional knowledge and perspectives.
2.8 GREEN CURRICULA RESOURCES ARE READILY AVAILABLE				
ESD resources are provided for teachers including a variety of media, sample units of study, course profiles, teaching guides, electronic and text-based resources.	The institution is beginning to address greening in some subjects.	Some subjects have greening incorporated in content and teaching methodology.	Greening components are incorporated in most subjects across grades and learning programmes in the institution or at the workplace.	All subjects have greening components across all grades or programmes that are user friendly and accessible in various formats.
2.9 TEACHING/PEDAGOGY REFLECTS GREENING				
Pedagogical approaches involve systems thinking, inquiry, discovery, active learning, problem-solving and futures thinking emphasizing both a local and a global approach adaptable for teaching in the classroom or learning at the workplace.	Greening is not integrated into the institution's own PD programmes, but rather accessed through professional associations.	Greening is part of PD in some subjects.	All central PD has a greening component.	All central PD integrates greening and inclusive practices that include their contributions as global citizens. Professional associations offering PD collaborate with the institution in offering such programmes.
2.10 GREENING REFLECTED THROUGH THE USE OF LOCAL EXAMPLES				
Natural and human-built environments are utilized as sites of discovery and active learning.	ESD instructional strategies are limited to classroom instruction.	The institution building provides a site for understanding and addressing energy, waste and water issues through curricular or extra-curricular activities.	The institution building, grounds and local community are used as sites to understand sustainability issues and take action through curricular or extra-curricular activities.	Service learning that incorporates the principles of greening is a requirement in every course and includes a focus on the institution, and the local and global community.

2. CURRICULUM AND TRAINING	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
2.11 STUDENTS LEARN GREENING FROM INSTITUTIONAL PRACTICE				
Institutions provide a safe and supportive learning environment in which students are engaged in decisions about their institution and their learning of greening perspectives.	Students are encouraged to discuss their concerns regarding what is taught, as well as assessment systems.	Some students are engaged in an institution advisory committee to address the greening programme.	Most students are engaged in the institution's greening undertaking. Skills regarding the rights and responsibilities of workers are taught as well as the politics of the workplace to provide skills that enable the students to green their future workplaces.	The student voice is actively sought in designing the greening process. Students develop a sense of responsible global citizenship that encompasses their actions in the workplace and personal lifestyles.
2.12 GREENING AS PART OF CORE ASSESSMENT STRATEGIES				
Transparent assessment mechanisms monitor student achievement in greening, including action-learning approaches.	No student data is collected at the system level.	Credit accumulation and graduation rates are compiled with the goal of providing support for continuous improvement and sharing of promising greening practices.	Report card data, credit accumulation and graduation rates are compiled at the system level to provide support for continuous improvement and sharing of promising greening competencies that can be included in assessment schemes.	A process collects and monitors student achievement based on greening proficiencies, e.g. knowledge, skills and perspectives. Greening competencies are rigorous and highly respected in evaluation schemes. Learning communities among staff and students share ideas and promising greening practices and emerging competencies. Service learning requirements that address greening are assessed as part of courses.

2. CURRICULUM AND TRAINING	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
2.13 WORKPLACE-BASED LEARNING				
Cooperative, workplace-based, experiential and other forms of learning styles support greening partnerships with the community and potential employers.	A policy allowing student engagement with the community or businesses exists.	Some students in a particular course are engaged in an outside greening initiative.	Most students have the option of a variety of learning sites, learning modalities and learning placements to accommodate greening skill acquisition.	There are policies and procedures to track and ensure the maximizing of student engagement, skill acquisition and safety while exploring the emerging field of greening the world of decent work.
2.14 LEARNING THROUGH COMMUNITY/WORKPLACE ENGAGEMENT				
Opportunities exist to engage parents, the community, and businesses in the practice of greening principles.	There is awareness that such opportunities would be helpful to students, the institution, the community, and businesses.	A process to engage the parents in the greening initiative exists.	Some representatives of public and private sector institutions engage in teaching staff and students about emerging greening initiatives in existing courses or potential courses that the community or businesses need.	The businesses and the wider community are both advising and actively engaged in the greening initiative. The greening initiatives encompass more than the institution itself and have foci both within and beyond the local community to engage the students and staff in the concept of global citizenship.

3 GREENING OF RESEARCH	DEGREE OF IMPLEMENTATION			
Desired Outcomes	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
3.1 GREENING IS A RESEARCH PRIORITY				
Greening the research agenda becomes an integral component of the institutional culture.	Research is not currently part of the institution culture or vision.	Research is seen as an asset but is neither excluding nor focused on sustainable development issues.	Greening and related sustainability issues, either local or global in nature, are an important focus for the research agendas of staff and students. Green research projects are incentivized and rewarded.	Research into greening is seen as an important output of the institution. Research is also viewed as an important learning tool to help staff and students understand how to teach and learn about greening in an effective, relevant and enjoyable manner. Research associated with greening is a priority.
3.2 BROAD-BASED RESEARCH GUIDING THE GREENING PROCESS				
The institution utilizes research-based evidence to inform institutional processes and plans.	Research evidence is used by institutional staff for individual needs.	Research evidence is used by institutional staff and administrators for individual as well as institutional needs. It is used as the basis for some academic/ programmatic/ technical decisions. Tracer studies are periodically conducted to understand the pattern of industry uptake of graduates and skills.	Research evidence, including that on the national scale, is used regularly by the institution as the basis for updating its programme offerings. Labour-market information generated from cross-sector data is used as the basis for offering skills-based programmes. Tracer studies are conducted to follow trends and the patterns of industry uptake of graduates and skills, their salary, income and role.	Tracer studies are regularly conducted to follow trends and the pattern of industry uptake of graduates and skills, their salary, income and role. The results of these are communicated to students as part of career counselling programmes. TVET programmes are dictated by labour-market skills forecasting results and adjusted according to industry-expressed qualification requirements.

3. RESEARCH	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
3.3 LOCAL/INSTITUTION RESEARCH INFORMS GREENING				
The institution develops tools to collect data useful for systemic reforms.	Research is considered a part of the institutional reform agenda.	Research teams in institutions are mobilized to gather information and data on the ground, including student difficulties, barriers to teaching green skills and perceptions on green-related initiatives.	Reports from research are shared with the management team to foster participatory decision-making.	Reports from research are shared with the management team and relevant stakeholders to foster an open space for discussion, participatory decision-making and systemic reform strategy.
3.4 GREENING RESEARCH EQUIPMENT AND PROCESS				
Energy consumption and the environmental pollution caused by research equipment and activities is minimized.	Research equipment is procured and maintained in compliance with mandatory environmental and public health standards. Storing and disposing of hazardous chemicals and wastes is in compliance with the law.	Energy saving is advocated for use of research equipment. Inventories have been established of research equipment and chemicals. Lab and research wastes are specifically considered in the waste management of the institution.	Research buildings and equipment are designed to be flexible during their life cycle to meet changing research focuses and requirements. The use of research equipment and materials that have potentially hazardous effects is minimized or avoided.	The energy consumption and sustainability impacts of research equipment and activities are regularly audited. Generation of wastes in research activities is reducing or prevented.
3.5 RESEARCH COLLABORATION ON SUSTAINABILITY ISSUES				
The institution mobilizes inter-agency collaboration and expertise from different departments for research on interdisciplinary sustainability issues.	There is awareness and identification of interdisciplinary sustainability issues.	Research proposals are encouraged that align the research interests of different departments and use interdisciplinary research methodologies.	Institutional and financial support is mobilized for concretizing promising interdisciplinary research initiatives.	A research community is engaged with the participation of highly motivated and focused teachers, students, and external experts from different disciplines to solve a specific sustainability issue. The research is implemented and its results are reported.

4 GREENING THE COMMUNITY AND THE WORKPLACE	DEGREE OF IMPLEMENTATION			
Desired Outcomes	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
4.1 PARENT/COMMUNITY PARTNERSHIPS				
Parents and the community are actively engaged in addressing local sustainability issues through community projects and/or partnerships.	There is seldom active engagement of parents and the community. Greening practices are presented in newsletters or community meetings.	Institutions are encouraged to involve parents and the community in greening initiatives. There is engagement of parents and the community in greening practices in some institutions, going beyond communications through newsletters or community meetings.	PD and resources are provided to assist institutions in working with parents and the community in developing and promoting greening initiatives in institutions, homes and the community. Most institutions demonstrate the engagement of parents and the community in greening practices.	Parents and the community are engaged with greening initiatives. PD and resources are available to parents and staff for community and workplace collaboration. Parents and enterprises are engaged with the institution in greening initiatives and understand their importance in students' future success.
4.2 COMMUNITY/BUSINESS PARTNERSHIPS				
Cooperative education supports greening partnerships with the community or with businesses that are potential employers.	Some institutions have partnerships with community groups and businesses to support student volunteers or cooperative (experiential) learning.	Institution leaders are encouraged to involve the community/ businesses in partnerships that support programmes and initiatives that contribute to the development of responsible workers and citizens.	Workplace partnerships are encouraged and supported. Institutions are involved in institution–community or institution–business partnerships that support student success.	All institution leaders receive PD and support to develop partnerships that contribute to the learning of responsible citizenship, career awareness and contributing to a sustainable community or green workplace and commerce.

4. COMMUNITY AND THE WORKPLACE	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
4.3 JOINT SUSTAINABILITY PLANNING				
Community/workplace sustainability plans are part of the curriculum and are used to bring relevance, scale and practicality to the classroom.	A few faculties are aware of the local sustainability or greening workplace issues.	The institution has sought or identified the local sustainability issues and uses them as teachable issues.	The institution has sought out the local sustainability plans, visits the sites and uses the plans to engage the students in creating solutions.	The institution, faculty and students are engaged with the community or businesses in partnership in order to address the sustainability issues in the local community or at workplaces.
4.4 SUPPORTING COMMUNITY EMPLOYMENT NEEDS				
The institution has mechanisms to convey the green agenda to employers and other stakeholders.	Employers in the community have an awareness of the sustainability concepts adopted by the institution.	Employers in the vicinity are convinced about the Green Master Plan and the vision of the institution. Employers maintain regular interaction with the institution to advise on progress and local market needs/ developments.	Employers have demonstrated interest to make use of the institution to teach/ train their employees using a curriculum or programmes that apply environmental or green skills. Employers and the institution have a formal scheme to train students on enterprise-based green practices and technologies.	The institution and employers work collaboratively in co-developing programmes and events that reflect sustainability practices. The institution is acknowledged in the community for its demonstrated community of practice on greening and is a regarded source of qualified and trained environmentally friendly graduates.
4.5 ADVOCATING SUSTAINABILITY WORKPLACE PRACTICES AND DECENT WORK				
Graduates have a working knowledge of 'decent work' and sustainable workplace practice, as well as skills to bring the concepts to the workplace.	Students have an awareness of decent work.	Students know the core aspects of decent work, inclusivity and sustainable work codes and practices.	Students have basic skills of organizational change theory.	Students have the knowledge and social skills to fully assist in greening their future workplace.

5 GREENING THE INSTITUTIONAL CULTURE	DEGREE OF IMPLEMENTATION			
Desired Outcomes	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
5.1 POLICY				
A systemic approach to implementing greening priorities is reflected in the institution's entire strategic planning, asset management, policies and institutional improvement plans.	Greening priorities are limited to policy documents or decisions.	The Institutional Strategic Plan includes greening as one priority. Greening is included in the TVET transformation plan.	The Institutional Strategic Plan includes greening as one priority. There is system support for implementation. Institutions share their greening with external stakeholders (parents, communities, partners).	Greening is part of all Institutional Strategic Plan priorities and asset management policies. The institution includes greening in its plans, in its assessment strategies for teaching and learning, and the performance plans for all staff. The institution shares its greening success with the community.
5.2 DECISION-MAKING				
The system and its institutions embrace a transparent, inclusive, participatory approach to decision-making, involving all partners. The institutional culture is underpinned by a sound values and ethics framework.	Policy development and strategic planning are limited to senior staff. There is no greening master plan protocol. Greening ethics and values is not identified as an overt issue.	Senior staff are involved in planning and policy development with limited input from staff, students and community. The system provides transparent communication to staff, community and trustees. Greening ethics and values are identified as targets in the greening process.	All employees are included in strategic planning and policy development. The system has a protocol for open and transparent consultation and communication with staff, students, community and trustees on the subject of policy. Greening ethics and values are embedded in the curricula and evaluation schemes.	The institution models democracy, with students, teachers and community representatives engaged in decision-making. Greening ethics and values are broadly understood and are acknowledged in the Master Plan and reflected in the whole institutional culture affecting all aspects of decision-making.

5. INSTITUTIONAL CULTURE	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
5.3 FINANCE AND BUDGETING				
Financial support for IGP initiatives is adequate and a priority.	Budget priorities seldom address greening.	Budgets reflect IGP priorities in departments such as facilities and programme.	Budgets in all departments reflect some commitment to the IGP.	Greening is a priority of the whole-board budget planning and demonstrates measurable impacts, such as cost savings in facilities.
5.4 MONITORING AND EVALUATION				
Assessment strategies measure progress in systemic implementation of IGP initiatives.	There is little assessment or strategy determining the progress of the IGP in any department.	Ongoing assessment of the impact of waste and energy management in facilities (environmental assessment) is in place.	Development and implementation of an assessment strategy to determine the impact of implementation of the IGP in all departments is in place.	A systemic assessment strategy that includes PD, continuous improvement, and identification and celebration of promising practices is in place. Results are shared with staff, community and trustees.
5.5 LEADERSHIP				
System administrators demonstrate commitment and leadership in the implementation of an IGP across the system.	Institution administrators are aware but do not really understand greening, or see it as a priority.	Institution administrators see the IGP as a priority and set up a process to form and guide an ongoing initiative.	The IGP is extended to cover all aspects of the institution and all employees are engaged.	Greening is embedded in vision/mission statements and funded in the core budget. Students, staff and community are aware of this commitment.
5.6 RECOGNITION				
Staff are recognized and rewarded for greening leadership.	There is no demonstration of true commitment to the IGP from system and institution administrators.	An award scheme is co-developed by the administration, unions and relevant professional organizations.	Greening recognition is a component of promotion and contributing to further workplace advancement.	Staff, students and administration see the recognition of the IGP outcomes as significant, and these outcomes are widely acknowledged beyond the institution. All see the award scheme with personal satisfaction as recognition of their contributing to global citizenship.

5. INSTITUTIONAL CULTURE	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
5.7 INCLUSION IN THE IGP				
The institution provides an inclusive learning environment that fosters the consideration of alternative perspectives, worldviews and ways of knowing, in order to clarify values and adopt an informed position.	There is limited focus on an inclusive learning environment.	The institution has extracurricular activities that reflect the needs and interests of the institution.	Institution staff engage students and parents in developing an inclusive institution environment.	An inclusive institution environment is a major focus in planning and implementing all institution activities, including parent engagement initiatives.
5.8 SUPPORTING THE IGP PROCESS				
The institution provides a safe and supportive learning environment in which staff and students share responsibility for what is learned, how it is learned and how it is assessed.	Teachers set learning content, process and assessment without student input.	Some are involved in student-led inquiry to identify questions that learners work together to address. Teachers set assessments.	Student-led inquiry identifies questions that learners work together to address at all grade levels. Authentic assessment is designed with students.	Learning is directed by questions that teachers and students work together to address. Both process and products of learning are assessed.
5.9 PROFESSIONAL DEVELOPMENT OF TEACHING AND SUPPORT STAFF				
PD provides teaching staff with greening competencies, including knowledge, skills, perspectives and pedagogy. PD provides non-teaching staff with the knowledge and skills to further the greening goals of the institution and the system. Staff share good practice, learning models and resources that support the IGP.	Greening is emerging as a focus for PD. Greening is not a focus for PD. There is a limited sharing of greening practices among institution staff.	Teaching staff in some subjects receive PD on greening. Some staff receive PD on greening. There are occasional opportunities for institution staff to share successful greening practices and resources.	All teaching staff receive PD on greening. All faculty members receive PD on greening. There are regular opportunities for institution staff to share successful greening practices, models and resources.	Greening is integrated into PD for all teaching staff and central staff involved in working with students. Greening is integrated into PD for all administrative and support staff. Learning communities are established across divisions to share successful practices, models and resources.

5. INSTITUTIONAL CULTURE	BEGINNING	SOME PROGRESS	SATISFACTORY PROGRESS	STABLE AND EMBEDDED CHANGE
5.10 RECOGNITION OF KNOWLEDGE, SKILLS AND COMPETENCIES				
Greening of the knowledge, skills and competencies are addressed in performance appraisals and hiring policies.	Staff hiring and performance appraisal may occasionally include greening understanding or commitment.	Leaders are aware of greening as a factor in hiring and may choose to use it.	All staff performance appraisal and hiring has a greening component.	Recruiting, hiring and performance review protocols have a greening component that includes evidence of greening.
5.11 EMBEDDING HUMAN RESOURCES (HR) GREENING PRACTICE IN INSTITUTIONAL POLICY				
HR policies for all system staff support greening capacity-building, mentoring, and collaborative and lifelong learning.	Some HR polices are seeking to address greening.	Greening is found in a few policies.	All policies are reviewed for a potential greening component.	Board HR policies and programmes are in place to support all staff in building an understanding of greening and the necessity to act.
5.12 INCLUSION ASPECT OF GREENING				
Diversity is celebrated and is reflected in the staff and all their work to build respect among all members of the institution and community.	There is no planned diversity training or hiring protocol to recruit a diverse workforce. No formal recognition of greening leadership is in place.	Respect for and understanding of diversity is part of PD for teaching staff. Some institutions celebrate greening leadership at staff meetings.	Respect for and understanding of diversity is part of PD for teaching staff. Diversity of staff is a real priority. Recognition of greening leadership is celebrated at institution-wide level.	The degree of diversity in the workforce is measured. The workforce reflects the diversity of the institution and community. Respecting diversity is part of PD for all staff. Greening leadership is celebrated in the media.

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ACRONYMS AND ABBREVIATIONS

AACC	American Association of Community Colleges
AIT	Austrian Institute of Technology
BOD	Biochemical Oxygen Demand
CETVETAR	Department of Vocational Teacher Education of the Centre for Technical and Vocational Education, Training and Research (Nigeria)
CEDEFOP	European Centre for the Development of Vocational Training
DESD	Decade of Education for Sustainable Development
ESD	Education for Sustainable Development
ESP	Environmental Sustainability Practices
FET	Further Education and Training
FFA	Force-Field Analysis
GAP	Global Action Programme on ESD
GCE	Global Citizenship Education
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
HR	Human Resources
ICT	Information and Communication Technology
IGP	Institutional Greening Plan
ILO	International Labour Organization
INA	Instituto Nacional de Aprendizaje
M&A	Monitoring and Assessment
NGOs	Non-Governmental Organizations
PD	Professional Development
QE	Quality Education
SD	Sustainable Development
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SIP	School Improvement Plan
SSVs	Skills Shortage Vacancies
SWOT	Strengths, Weaknesses, Opportunities and Threats
TESDA	Technical Education and Skills Development Authority (Philippines)
TVET	Technical and Vocational Education and Training
UNEVOC	UNESCO International Centre for Technical and Vocational Education and Training
UNDESD	UN Decade on Education for Sustainable Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund

United Nations
Educational, Scientific and
Cultural Organization

UNEVOC

International Centre
for Technical and Vocational
Education and Training

This *Guide* describes the macro need for TVET reform in conformity with the Sustainable Development Goals, the Global Action Programme (GAP) on Education for Sustainable Development (ESD), and other United Nations, UNESCO and national initiatives. The *Guide* also provides specific practical help for institutional greening transition teams to plan and carry out the changes that are deemed necessary. It is essential that all such greening undertakings have a clear vision, are known to all those concerned, follow a strategic plan, set targets and milestones, and include a monitoring/assessment tool. The concept of shared vision and team reformation combined with the support of senior leaders is evident throughout this *Guide*. A major goal is that greening will grow into an ongoing process which is eventually infused into the culture of each institution.

Specifically included in this *Guide* is a rubric or framework designed for most TVET institutions. The rubric/framework is designed as both an assessment tool and a learning instrument, as it contains clear descriptions of possible goals and destinations. Since TVET institutions and programmes are so varied, these suggested assessment goals are also designed for discussion and adaptation to the specific situation on each site, while modifications are encouraged.

The central theme is Greening the Institution, while also embracing the broader concept of education for sustainable development (ESD). In particular the focus is on the role of TVET in delivering a crucial element of the GAP. By having local teams of leaders, faculty, students and community experts working in concert and infusing the concepts of related educational initiatives, the institution will transition itself into an even more effective and meaningful greening agent for its graduates, its communities and all who are associated with the institution.

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4 QUALITY EDUCATION

Sustainable Development Goals